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AMERICAN INDIAN PERSISTENCE IN STEM-RELATED GRADUATE DEGREE PROGRAMS

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AMERICAN INDIAN PERSISTENCE IN STEM-RELATED GRADUATE DEGREE PROGRAMS

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"And I wonder if, in the dark night of the sea, there, deep within its own sphere of instinct, the octopus dreams of me." – N. Scott Momaday

This quote decribes a man helping a stranded octopus return to the sea. The meaning can be interpreted various ways. The entire story reminded me of my educational journey. The teachers who helped me along the way will never be forgotten.

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Abstract

Historically, American Indians (AI) continue to struggle to meet the same levels of educational success as their United States counterparts. Moreover, AIs are the least represented group earning a college degree in the areas of science, technology, engineering, and mathematics (STEM). Previous studies have focused on AI undergraduate persistence, yet there remains a void in the area of graduate level success in STEM-related fields for AIs. This study used a phenomenological method to discover three areas of interest. First, the AI participants in this study became interested in STEM-related subjects at different times in their lives. Second, having teacher mentors at critical times in the AI participants' school career was necessary for their success. Third, peer collaborative learning was a fundamental part of their success in STEM-related curricula at the both the undergraduate and graduate level. The findings of this study reveal the need for future research in the area of AI STEM-related education.

Keywords: STEM, Education, American Indian, persistence, collaborative learning, mentoring, graduate level.

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MANUSCRIPT

American Indian Persistence in STEM-Related Graduate Degree Programs

Introduction

From the colonial period to the present day, educational intentions of the United States government for American Indians (AI) have been primarily unsuccessful when compared to their counterparts (Carney, 1999; Glenn, 2011; Layman, 1942; Reyhner & Eder, 2004). According to Lundberg (2014), when AIs consider formal education in the United States, their perceptions are shaped by historical and contemporary injustices. Regardless of race or culture, factors that may determine persistence for all groups of students may include, but are not limited to, family support, financial support, and pre-college academic preparation. Most research conducted on AI education persistence regards pre-college academic preparation as a crucial factor for success (Benjamin, Chambers, & Reiterman, 1993; Falk & Aitken, 1984; Huffman, 2003; Plevney; 2012). But, for AIs, academic preparation prior to postsecondary education is only one critical factor determining persistence (Hoover & Jacobs, 1992).

AIs do not persist in higher education at the same rate as the general population including the population of other minorities (Hoffman, Jackson, & Smith, 2005). Graduation rates for AIs are less than half of their white counterparts (Bergstrom, 2012), and the lowest of any minority group in the United States (Hunt & Harrington, 2008). Even though AI graduation rates are lower than their counterparts, there is an increase in the number of AIs attending college over the past 40 years (Bergstrom, 2012). This increase is also reflected by an increase in AI students planning to major in the areas of science, technology, engineering, and mathematics (STEM) (National

Science Board, 2012). Despite the overall increase in college and STEM enrollment, there still remains retention concerns, especially for women and minorities (Whalen & Shelly, 2010). From an international perspective, the entire United States is lagging behind other countries in the number of STEM degrees granted at higher education institutions. For example, the National Math & Science Initiative (NMSI, 2014) reported for the year 2008, 31% of all United States bachelor's degrees awarded were from the science and engineering fields, compared to 61% for Japan and 51% for China. Furthermore, the NMSI reported that 38% of the students who start with a STEM major do not earn a degree within a STEM field. Although the need to increase the number of STEM graduates is desirable for all student groups, this study will focus on successful AIs who have earned graduate degrees in STEM-related fields.

According to the National Science Board (2012), AI/Alaskan Native freshmen were the least represented minority group in higher education that indicated the intention to major in a science or engineering field. There are similar findings at the graduate level. The National Science Foundation (2013) indicated that there were 626,820 graduate students in 565 academic institutions. Of that total, 450,523 were United States citizens and permanent residents, with only 2,741 of AI/Alaskan Native descent.

While the numbers for AIs enrolled in graduate school are small, it is a positive indication that some AIs do succeed in education despite Bergstrom's (2012) claim that the past 400 years of AI education has been a "National Tragedy" (p. 1). Even though there are studies on AI education (Glenn, 2011; Layman, 1942; Reyhner & Eder, 2004) there are limited publications exploring AIs attending higher education institutions

(McClellan, Tippeconnic Fox, & Lowe, 2005). Terms often used to describe their educational experiences are attrition, persistence, and retention (Adelman, Taylor, & Nelson, 2013; Benjamin, Chambers, & Reiterman, 1993; Falk & Aitken, 1984; Guillory, & Wolverton, 2008; Jackson, Smith, & Hill, 2003; Oosahwe, 2008; Pavel, & Padilla, 1993; Tierney, 1992). Furthermore, there are limited studies focused on AIs who successfully earn a graduate level degree in any subject. At the time of this study, no research literature has been identified that focused on persistence factors of successful AIs who earned graduate degrees in STEM-related fields. Adelman et al. (2013) indicated that AIs are the least represented student group in graduate degree programs. Therefore, this phenomenological study contributes to the knowledge base by exploring factors that allowed certain members within the AI population to earn graduate degrees in STEM-related fields.

Literature Review

Historically, AIs have been "pushed and pulled into the dominant culture" for the past five-centuries (Deloria & Wildcat, 2001). As a result, research implies that many AI parents have negative views towards the formal education system in the United States (Adelman et al., 2013). Yet, research has shown that the AI students' families are an integral part for success in postsecondary institutions (Falk & Aitken, 1984; Guillory & Wolverton, 2008; Jackson et al., 2003; Oosahwe, 2008; Pavel & Padilla, 1993). However, the influence of family may be an obstacle that hinders AIs from attaining a college degree. For example, AI families may ask students to return home for tribal ceremonies or assist with family matters; these events may cause excessive absence from college classes (Jackson et al., 2003). The example provided is

evidence in the literature that AIs face significant barriers to education not encountered by their counterparts (Hoffman et al., 2005). Since Layman's (1942) study on AI education, AIs are still confronted with the phenomenon of educational underachievement.

Retention/Persistence of AI Students

Since there is limited research in AI STEM graduate education enrollment, this section will provide a general framework on college level retention/persistence for AI students at the undergraduate level. When AI students dropout at the undergraduate level from higher education institutions, it not only causes adverse conditions for the individual, but also affects their families and communities (HeavyRunner & DeCelles, 2002). In the general population, student departure from postsecondary institutions is not an uncommon phenomenon. But, for AI students, additional challenges exist at public higher education institutions that are not experienced by mainstream students (Bergstrom, 2012). In fact, AI retention rates at higher education institutions remain extremely poor when compared to other ethnicities (Pewewardy & Frey, 2004).

Tinto (1975) argued that students' backgrounds influences their experiences during college. Yet, Tinto's model (1975) has been criticized, especially when applied to AIs (Tierney, 1992). Pavel and Padilla (1993) examined Tinto's model to see how it fits with AI student data. The data for their research participants were drawn from the National Center for Education Statistics' *High School and Beyond*, a national longitudinal database of sophomore and senior cohorts from 1980 to 1986. The statistical method of structural equation modeling was used, and after fitting the model to both the sophomore and senior cohorts, the most important variables for AI student

retention were family background, postsecondary intentions, and formal and informal academic integration (Pavel & Padilla, 1993). The most significant factor prior to attending college for both groups was family background. Overall, the model was a modest fit using AI data, which means other factors outside of Tinto's model could be influencing postsecondary retention at the undergraduate level (Pavel & Padilla, 1993).

The findings of Pavel and Padilla's (1993) research support previously published literature by Falk and Atkins (1984), where they suggested creating programs that foster family support and the increase of college participation for AI families to improve transition to the college lifestyle. Moving away from home is a challenge for all incoming freshman, but it is especially difficult for AI students (Demmert, 2006). Additionally, post-secondary institutions are often viewed as unsupportive environments and situations for AI students (Carney, 1999). Thus, Pavel and Padilla (1993) emphasized the need for support programs that would eliminate homesickness for AI students by creating a more positive environment at higher education institutions. These recommendations would assist the AI student by providing a positive coping strategy while away from home. According to Guillory and Wolverton (2008), mainstream postsecondary institutions have historically struggled to accommodate AI students. Thus, a need remains for programs to support AI students to help develop social skills related to the college culture, both socially and academically (Bergstrom, 2012).

In a multiple case study-like approach consisting of two stages, the within-case and cross-case analysis, Guillory and Wolverton (2008) explored similarities and differences between AI student perceptions as well as the perceptions of various

administrations and faculty. They focused on factors for persistence and barriers to degree completion at various colleges in the Northwest. Qualitative information was gathered, and the researchers interpreted the information examining processes and outcomes that were common across the cases. The participants included AI students, state representatives, college presidents, and college faculty. In this study, the term "institution" referred to state employees who had the potential to impact AI students attending universities in Washington, Idaho, and Montana (Guillory & Wolverton, 2008). Institutions and students were asked to identify three or four of the "most important" factors that helped AIs persist in addition to the barriers they must overcome to complete a degree program.

The findings by Guillory and Wolverton (2008) revealed that the most prevalent persistence factors identified by the institution group were financial support and academic programs (i.e. bridge programs). The institution group also identified inadequate financial resources and the lack of academic preparation as barriers to complete a degree program for AI students. In comparison, the student group identified persistence factors as family, giving back to the community, and social support on campus; whereas, the barriers identified included family, single parenthood, academic preparation, and financial support. Of the above-mentioned persistence factors, family was the most frequently used by AI students (Guillory & Wolverton, 2008).

When AI students attend a higher education institution, the culture is often unfamiliar when compared to their own background (Tierney, 1992). Independence is the culture of higher education institutions rather than interdependence (Stephens, Fryberg, Markus, Johnson, & Covarrubias, 2012). In their study of AI student

persistence, Falk and Aitken (1984) included college personnel consisting of a scholarship officer, financial aid counselors, and AI student counselors. Falk and Aitken (1984) used a systematic and objective method to determine the perceptions of college for AI students and personnel from several colleges and universities in the Midwest. These researchers used a mixed method approach by interviewing 125 students and 11 college personnel and applying Spearman correlations to determine factors that increase/decrease AI student retention. Overall, college educators indicated three primary areas of concern for AI student retention: (a) good academic preparation, (b) personal motivation, and (c) financial support (Falk & Aitken, 1994).

Relating to AI student background and academics, Falk and Aitken (1984) discovered only 21% of the AI students self-indicated they were sufficiently prepared for college level work, while 76% reported being only somewhat prepared or not prepared at all. After applying Chi Square and Spearman correlation analysis, Falk and Aitken (1984) reported that more years of school completed by AI students was positively correlated with having career goals, parents who supported their field of study, and parents who supported them financially. In similar fashion, years of retention were related to the parents' years of education. Additionally, the lack of personal motivation and academic preparation in high school resulted in a high ranking for AI student obstacles (Falk & Aitken, 1984).

There are noteworthy findings among the interviewees in the Falk and Aitken (1984) study. First, personal motivation needs to be present for AI students to persist. Second, 100% of students surveyed indicated that having AI faculty and staff was important for student retention. Third, 90% of the students indicated institutional

commitment with appropriate counseling programs and services for AI students are of high necessity. Demmert (2006) agreed that it is important for higher education institutions to meet the needs of different cultures. Likewise, Adelman et al. (2013) argued that a comprehensive intervention of support and guidance addressing barriers to AI students is necessary throughout preK-16.

Past research indicates that some obstacles may be unique to AI students, and to complicate matters further, the differences between reservation and non-reservation AIs must also be explored. It can be presumed that reservation AIs will be more involved in their culture than non-reservation AIs (Huffman, 2003). Therefore, it can also be assumed that transition to higher education institutions for reservation AIs will be more difficult. As in the previous literature, Huffman (2003) had the goal of identifying perceived barriers for AI students while attending college. A survey on attitudes, perspectives, and experiences was administered to 101 AI students at a small Midwestern university. The respondents were divided into subsamples of reservation (R) and non-reservation (NR) background for statistical analysis. A Pearson's correlation and t-test were used to determine relationships between variables and comparison between the R and NR groups on perceptions and experiences (Huffman, 2003). Overall, the barriers identified by AI students were related to academics, finances, and personal/social difficulties.

Other findings within this study recognized that R-AIs have more academic difficulty than the NR-AIs, yet financial difficulties, and personal/social difficulties are reported by both subgroups (Huffman, 2003). The level of satisfaction with college experiences was the same for both R-AIs and NR-AIs, although the transition was more

difficult for R-AI students. A probable explanation for the R-AI student transition to college life may be due to living farther away from home when attending public postsecondary institutions and being more removed from their culture (Huffman, 2003). Regardless of the easier transition of NR-AIs, the retention rates for both groups remain lower than the general population (Huffman, 2003).

Jackson et al. (2003) also included the criteria of AI reservations when they sought to identify barriers for AI students and how they overcome these barriers. They interviewed 15 AI college level seniors at five, four-year higher education institutions in the Southwest. One main criterion for each student participant was living on a reservation and attending school on that reservation for at least two of the last four years prior to attending college. This study utilized a qualitative method founded on relational ontology, hermeneutics, and dialectics (Jackson et al., 2003). The results identified surface themes and deep themes, the former was identified and consistent with previous research, but the latter was more personal and complex. Surface themes were related to family and college experiences while the deep themes involved subtle prejudices and racism (Jackson et al., 2003). AI students expressed difficulties within the college environment, yet each theme ultimately involved family support as a coping strategy for overcoming barriers. Jackson et al. (2003) also identified student difficulties tied to family, such as, the lack of understanding by the family as to why the student must leave home for extended periods of time. In addition to family difficulties, peers may also become a negative factor for AI college students. For example, making the commitment to pursue a college degree at a location other than their reservation may cause the labeling of the AI student as a "sell out" (Jackson et al., 2003).

In the literature, recommendations for aiding the persistence of AI students typically involve programs to assist in transitions from home to school (Demmert, 2006; Guillory & Wolverton, 2008; Pavel & Padilla, 1993). Even more, according to Jackson et al. (2003), these programs must also involve AI tribal leadership. These authors acknowledged that AI leadership involvement becomes particularly important for those who lack strong family support. Jackson et al. (2003) also suggested dialogue between family, high school counselors, tribal leaders, and students. The dialogue should start during the students' early years of school and continue through college. The subject matter within this dialogue must include coping with loneliness away from home, racism, traditional spiritual resources, bicultural identity, and maintaining cultural identity (Jackson, et al. 2003).

Benjamin et al. (1993) argued that since AI success is such a rarity, scholarly literature has paid little attention to it. Even though higher education institutions are becoming more aware of the cultural background of AI students, they still feel isolated during class and from their college instructors. For example, AI students may lack background familiarity of certain classic literary works when compared to fellow classmates (Bergstrom, 2012). Appropriately, Benjamin et al. (1993) considered AI culture in their study to determine skills required for college persistence. They used a mixed method of social science and statistical methods exercising a culturally sensitive approach. Acknowledging Tinto's (1975) model, Benjamin et al. (1993) discovered when applying standard statistical procedures for AI persistence it lacked predictive power. Therefore, their focus shifted to a more qualitative method where they sampled 166 AI college freshmen from various tribes at a Southwestern mid-sized university.

These researchers found that while most AI students had marginal academic traits, the individuals who had a stronger educational background also lacked persistence at college. Research shows that college persistence is often tied to family encouragement (Guillory & Wolverton, 2008; Jackson et al., 2003; Oosahwe 2008). Yet, Benjamin et al. (1993) determined that the action of "going home" is often disruptive and complicated for AI students, especially since most AI students lack transportation and live far away from home. Those AI students who strategized family visits throughout the school year had greater persistence (Benjamin et al., 1993). Overall, Benjamin et al. (1993) determined that higher education institutions are partially to blame for the lack of AI persistence due to their lack of understanding that AI culture is significantly different from the college culture. Universities in the United States assume that all incoming students know the college "rules of the game" which are tied to "middle-class cultural capital" (Stephens et.al., 2012). This assumption becomes significant for AI persistence since AI youth often come from the poorest families and frequently live in substandard housing (Bowker, 1992).

Oosahwe (2008) applied a phenomenological method to better understand the successes of AI college students. Oosahwe's (2008) study used purposive sampling to identify both graduate and undergraduate AI students at a large Midwestern university. The participants in this study identified processes and strategies of persisting through their college experience through interviews, shared experiences in focus groups, and written journals. The most significant factor identified for success by AI students was motivation. Other researchers agree that motivation is essential for success (Falk & Aitken, 1984; Plevney, 2012). Motivation for AIs was specifically tied to making close

and extended family members proud, giving back to their community, and identifying with their culture (Oosahwe, 2008). Guillory (2009) agreed that staying connected to family is often an important factor for AI student success in higher education. Oosahwe (2008) acknowledged that further research might expose other factors related to AI higher education persistence.

Purpose of the Study

Even with positive gains for AIs in federal education policies and reform, underachievement is still common (Hunt & Harrington, 2008). Currently, the research literature in the area of STEM-related persistence for AIs at higher education levels is scarce. Therefore, the purpose of this study was to explore factors that influenced AI students' interest in STEM-related fields, and to examine how AIs successfully negotiated and persisted through the United States educational processes required to earn graduate degrees in STEM-related fields.

Identifying and understanding strategies that assisted successful AIs during their scholastic careers (K-graduate school) may be valuable in three areas. First, college-bound AI students will be more aware of barriers encountered by successful AI college graduates. Second, K-20 educators that serve AI student populations can identify and/or implement positive events that encourage students to pursue a STEM degree and ultimately remain in school. And finally, higher education institutions and their staff can better assist AI students by alleviating obstacles they may encounter while engaged within their STEM curriculum of study. Thus, two research questions guided this study: (1) What are the factors that influence AIs with a STEM-related degree to become

interested in science? (2) What are the factors that allow AIs to complete a graduate degree program in a STEM-related field?

Participants

I realize that my demographic background is similar to the participants and fit within the research parameters guiding this study. I am an enrolled member of a federally recognized AI tribe. I earned a graduate level STEM-related degree and I am currently pursuing my Ph.D. in science education. While in contact with the participants, I was mindful of my own past experiences and made a conscious effort to eliminate any personal presumptions. According to Moustakas (1994), complete elimination of preconceived ideas is rarely achieved, yet an attempt to execute this process reduces the influence of personal presuppositions. I was motivated to learn about other AIs who persisted through a graduate level STEM-related degree program. Therefore, the participants were free to disseminate their own experiences through open-ended informal interviews.

AIs represent a small portion of the population in the United States, and within the AI population those holding a graduate level STEM-related degree are less common. Thus, I utilized purposeful sampling to insure true representation of the AI STEM graduate degreed population. This type of sampling ensures that the participants have experiences related to the research questions and the phenomenon studied (Creswell & Clark, 2011). I intentionally chose to select participants who successfully earned an advanced degree in a STEM-related field. I assumed that having an advanced degree increases the likelihood for critical reflection and concise detailed explanations about their past experiences. According to Englander (2012), finding participants that

share the same experiences, and who are willing to participate in a study are often major challenges to phenomenological studies. Additonally, Pietkiewicz and Smith (2014) indicated that there is no set rule for the number of participants in phenomenological studies, since one participant may provide enough data related to the research question.

I identified nine potential participants through social networking and informally invited these persons to participate in this study. I received a tentative commitment to participate from each person. After sending a formal invitation letter and consent form to each person, only two individuals remained interested in participating. Probable explanations for this attrition rate may be due to the participants' busy schedule regarding the time commitment for this type of study, and/or reluctance to share their personal school experiences in a publication.

The two participants in this study self-identified as an AI from a federally recognized tribe with an earned graduate degree in a STEM-related field. I intentionally omitted their tribal affiliation thereby allowing the readers to consider AIs as a whole and not an isolated or divided people. Both participants attended K-12 in the United States public school system.

The female participant, Pamela (pseudonym), earned a master's degree in chemistry. After earning her degree she worked as a lead DNA analyst for a state law enforcement agency. Her mother earned an associate's degree in nursing, her father earned a bachelor's degree in education, and her maternal grandmother earned a master's degree, but she was unsure in what field. Her paternal grandparents did not attend college. Pamela was raised active in her AI tribal traditions until third grade.

The male participant, Joseph (pseudonym), earned a master's degree in aeronautical engineering, and a doctoral degree in science education. Prior to earning his Ph.D. he was a United States Naval aviator, test pilot, and an astronaut for the National Aeronautics and Space Administration. His mother earned an associate's degree in nursing, his father, maternal and paternal grandparents did not attend college. Joseph did not grow up in a traditional AI environment, yet remained close to his immediate AI family.

Methods

A qualitative research design using a phenomenological method with a narrative approach (Moustakas, 1994) was selected for this study to capture and identify AI STEM graduates' life experiences, and how these experiences relate to their successes. The phenomenological method seeks to understand the essences and meanings of human experiences by utilizing open-ended questions (Moustakas, 1994). Identifying detailed life experiences is effectively accomplished using a narrative approach (Creswell, 2014), which gives access to individual's experiences in the context of time, order, and change (Sandelowski, 1991). According to Giorgi (2006) the phenomenology method is often used inappropriately, especially when a researcher utilizes too many phenomenological methods and/or pundits as guides; ideally, they should follow only one methodologist. Therefore, this study followed the phenomenological framework of Moustakas (1994), with the modification of using two interviews instead of one.

A total of two informal face-to-face interviews were conducted in a library at a large West South Central research university. A university setting was chosen to produce a naturalistic setting related to the topic of the study (Crouch & McKenzie,

2006). During the informal interviews, I employed Epoché while bracketing the interview questions. Epoché is a Husserlian method described as being free from suppositions when viewing phenomena (Moustakas, 1994). Furthermore, Epoché challenges the researcher to form new ideas, feelings, awareness, and understanding of situations and experiences (Moustakas, 1994). Bracketing, as described by Hays & Singh (2012), involves setting aside one's experiences so the participants can express their own. According to Moustakas (1994), the focus of the research question(s) is placed in brackets and its analysis is viewed naively to recognize their essence of meaning. Although Moustakas' (1994) phenomenological method involves one interview to develop both textural descriptions or "themes" and structural descriptions or "potential meanings," I utilized two interviews to elicit more detail about the participants' past experiences. The first interview allowed for the development of textural descriptions, while the second interview enriched the essential characteristics of the participants' experiences. Both interview data were analyzed using imaginative variation, which seeks to view all the possible ways a phenomenon is experienced (Giorgi, 2006).

Limited literature exists regarding AI persistence at the graduate level in STEM-related fields. Therefore, the first interview consisted of six open-ended questions (Figure 1) that were developed and modified from previous studies related to AI persistence in higher education (Bergstrom, 2012; Guillory, 2009; Oosahwe, 2008). Both interviews were audio recorded while I took copious notes. After the first interview, a notebook was given to each participant for reflection purposes. The participants were asked to write down any pertinent information they recalled after the

conclusion of the first interview. Prior to the second interview, the first interview was transcribed verbatim using ExpressScribe software. Individual textural descriptions were synthesized from the first interview transcripts to refine the data into categories, followed by composite textural descriptions to find similarities between the participants. The second set of open-ended questions were developed after identifying 11 textural descriptions (Figure 2) that were shared between both participants from the first interview. The second interview was also transcribed verbatim using ExpressScribe software. The second interview allowed for clarification of subject material as well as validating recall consistency of the participants' experiences from the first interview.

1. When did you become interested in STEM-related education?
2. What event(s) and/or people influenced your interest in STEM fields?
3. Describe any barriers you encountered during your K-12 level STEM coursework/training?
4. Describe any barriers you encountered during your undergraduate level STEM coursework/training.
5. Describe any barriers you encountered during your graduate level STEM coursework/training.
6. Describe any other factors that aided in the completion of your STEM-related graduate degree.

Figure 1. Interview Questions

1. Theme: Grade school teachers as barriers
   Could you descrive how you coped with teachers that impacted your learning negatively?
   a) Did you have help from either the school (K-20) or family to overcome this barrier? Explain.
   b) How did this incident(s) impact your interest in STEM-related subjects?
2. Theme: Professor influence as mentors (undergraduate and graduate level)
   Could you describe in detail your first interaction with a college professor/mentor that allowed you to trust and confide in him/her?
   a) Could you describe the steps you took in developing a student/mentor relationship?
   b) Looking back, what did mentoring mean to your persistence in a graduate level STEM progam?
3. Theme: Dropping a course taught by an unsupportive professor
   Was the professor unsupportive to some/all students or do you feel it was an individualized occurrence related to culture?
   a) Could you reconstruct the events on how you handled the situation of retaking a course from a different teacher/professore?

b) Could you explain how changing professors impacted your persistence as a graduate student?

4. Theme: Excelled in the same STEM-related course (that was dropped) when taught by a diferent professor.
   After changing professors, could you explain the differences in the new course that allowed you to complete/excel in that particular course?
5. Theme: Extracurricular activities (athletics, art/music)
   Could you describe your experiences participating in extracurricular activities during K-12 (sports, music, or art)?
   a) Do you feel these experiences played a role in your persistence during your STEM-related graduate career? Explain.
6. Theme: College campus visits
   Did your visit to a college campus influence your decision to pursue a STEM-related college degree?
   a) Could you describe how your family felt about your college visit?
   b) What did the college campus visit mean to your persistence in either undergraduate or graduate college?
7. Theme: Social challenges
   Could you describe how you overcame the social challenges you encountered at the undergraduate/graduate level?
   a) Were there social challenges in STEM-related classrooms/subjects only or were there challenges present in other classrooms/subjects?
   b) Looking back, do you feel your social challenges were different from other students? Explain
8. Theme: Peer influence
   Can you describe any positive or negative incident(s) involving peers that increased your reluctance or desire to completing your STEM-related college degree?
   a) At what level (K-20) of your school career did peers have the most impact on your interest in a STEM-related field? Explain.
9. Theme: Collaborative learning
   Could you describe a specific incident(s) that caused/allowed you to accept/seek support from other students during your K-20 career?
   a) Do you feel this was paramount for your success in graduate level STEM-related curricula? Explain.
10. Theme: Brevity of familial influence in college experiences
    At which level of school (K-20) did your family show the most support for your interest in STEM-related subjects?
    a) Could you describe an incident where family support was crucial to your persistence in a STEM-related graduate degree?
    b) Do you feel that peers offered the same/less/more support than family during your graduate studies? Explain.
11. Theme: Brevity of American culture references
    Recalling American Indian culture, how and when did it become a significant factor to your present life/work situation?

Figure 2. Follow-Up Interview Questions

I utilized a modified Stevick-Colaizzi-Keen method for data analysis (Moustakas, 1994). This method employs Epoché and phenomenological reduction by

utilizing bracketing, imaginative variation, and synthesis of textural and structural descriptions (Moustakas, 1994). These processes were followed while preparing, collecting, and analyzing data created from interviews and verbatim transcription of the participants' experiences. It should be noted that only the female participant returned her reflection journal; therefore, for consistency, the journals were not used. Analysis of the data involved interpreting textural and structural descriptions from both interviews in order to develop the invariant aspects of the participants' experiences and construct meanings (Moustakas, 1994). Both variant and invariant components were identified from the data between the participants, and later compared to past non-STEM persistence literature. Furthermore, after both textural and structural analysis, I intentionally compared the data to my own experiences as an AI with a STEM-related graduate degree.

Findings

After employing Epoché, phenomenological reduction, and imaginative variation to develop possible meanings of the participants experiences, four major themes were exposed: (a) influence of teacher and professor on persistence, (b) importance of classroom community for persistence, (c) brevity of family influence on persistence, and (d) post-graduate involvement in American Indian community. According to the interviews, the first two themes were more prominent for these participants in persisting through a STEM-related graduate degree program while the last two themes played a lesser role. Within the four themes, several questions were developed to provide as much opportunity for the participants to share their experiences. I will concentrate on the invariant aspects of the data to develop the

essence of the experience of persisting through the United States education system to earn a graduate degree in a STEM-related field. Then, I will briefly address variant aspects and supplemental findings.

Influence of Teacher and Professor on Persistence

The difficulty adjusting to school environments is often compounded when an AI student becomes interested in science. Aikenhead and Jegede (1999) referred to this phenomenon as "cultural border crossing" where the student (tourist) requires an appropriate teacher (tour guide) to assist in adjusting to Western science. This "border crossing" event becomes vitally important when a teacher has a negative persona towards AI students.

Both participants described negative teacher interactions prior to graduating high school. However, neither participant sought help from other teachers, administrators, or family to cope with the situation. Not seeking help from others reflects upon their self-descriptions of being shy and introverted. Both acknowledged the negative impact on their self-esteem, and that it still lingers in their minds decades later. Pamela's incident involved a teacher in grade school who would ignore her in the classroom; it made her feel like she did not belong. She recalled, "I always stayed quiet and stayed away from him if I could, and I didn't participate in any exercises in his classroom where I felt different. I wouldn't ask questions, so it was like I wasn't there." Joseph recalled a negative incident from junior high school,

> A math teacher in eighth grade flat out told me I was not capable of doing algebra in the ninth grade. I don't remember her rationale for it, because I wasn't flunking. It hurt my feelings, like it would anybody's. I did not approach the school to complain. I did though many years later go back and talk to the former vice-principal and asked him about her, he knew exactly who she was, you

> know 30 years later he knew who I was talking about, it blew me away. I ended up taking pre-algebra in the ninth grade and I did great, I made an A.

While these negative incidents impacted the participants' self-esteem, both indicated that it did not impact their interest in STEM.

Both participants also encountered negative experiences from a professor as they navigated through college. They described their professors as unhelpful with the tendency to ignore their questions in a classroom setting. The impact of the negative experiences caused one participant to leave school, and the other participant to pursue another area of study. Neither participant reenrolled in a course taught by the unhelpful professors. Pamela revealed that it made her feel reassured to enroll with another professor for organic chemistry. She described her experience,

> The professor would answer other students' questions when I would raise my hand, he ignored me, and I really felt it was because I was Indian or a woman. He seemed to have the mindset that you had to be a male to be a scientist. For at least a year I changed my major several times to avoid his class, which I needed for my chemistry major, this lead me to eventually quit school. When I returned to school and knew I didn't have to take Dr. [name] again as a professor of organic, it gave me a push to get back in to chemistry. I knew it was going to be a better situation for me, and that's when I met Dr. [name] who became my mentor.

Joseph's experience with an unhelpful professor eventually worked out to his advantage as he explained,

> The professor was unsupportive to all students, but he was receptive to some, he never addressed my concerns. I went to the head of the department and filed a complaint, and he told me to drop the course, 'if you don't he will fail you.' I tried to talk to the professor, but he wouldn't talk to me. I went on to study control theory and systems. I was more interested in mathematical coursework anyway. Certainly my confidence was lower after dropping his course, but his course wasn't my area of interest, so I went towards something I was confident doing.

The negative interactions with teachers and professors impacted both participants' self-esteem in a negative way; however, both persisted through their STEM studies with the help of a mentor. The participants described mentors as friendly, trusting, and genuinely interested in their social lives, their studies, and their future. They also agreed that a professional friendship developed their confidence to confide in their mentor. Interestingly, the participants took multiple undergraduate STEM courses from their mentors.

Mentors also play a vital role in areas outside of the classroom environment. As an example, both participants dropped out of college during their undergraduate career, but with assistance from their mentors, both returned and graduated. Pamela explained her relationship with a mentor,

> After returning to school, Dr. [name] was glad I was back and she wanted to help me any way she could. She gave me more confidence, she encouraged me, she was always helpful, and taught me a lot about chemistry. She used her own money and time to take me to visit the chemistry department and graduate faculty at two research universities. She introduced me to all the chemistry professors at both schools and their research interests. She was very instrumental in my attending graduate school.

Joseph described his mentor relationship,

> The head of the math department took me under his wing and I eventually took several advanced math courses from him. He was friendly, very approachable, and he made me feel important. Knowing that a mentor cares about you and respects your questions in class means a lot. Our relationship was personal and professional, I trusted him. He introduced me to a retired navy captain, who I tutored in calculus, and those two essentially pointed me in the direction of the navy.

My experiences as it relates to the theme of "teacher and professor influence on persistence" are described below,

> Coincidently, I had a negative experience similar to Joseph's. When I transferred to a rural school during junior high I enrolled in a science course.

> The teacher asked me if I should be in this course. I didn't know how to answer that question, so I remained silent. He eventually made it clear to me that I should enroll in another course. It was very embarrassing for me to hear that in front of other students. I recall everyone staring at me. From that point on I decided to stay away from college preparatory courses in junior high and high school. This negative interaction with a teacher made English and math difficult for me when I decided to go to college.
>
> In contrast to Pamela and Joseph's mentor experience I did not have a mentor until my doctoral level. I can attest to the necessity of having a positive mentor, and the impact role they have on persistence in a STEM-related degree program. Mentors are vital for dialogue and sharing experiences related to school.

Both participants acknowledged the importance of mentors. Moreover, both put an emphasis on teacher mentors rather than peer mentors in this study.

Importance of Classroom Community for Persistence

Both participants expressed the difficulty of transitioning to college, since they described themselves as shy and introverted. However, upon their return to college, both agreed that the familiarity of the college environment made the social aspect a little less stressful. Additionally, once they reached the upper division STEM courses, their class sizes became smaller, and they became more familiar with other students majoring in the same field. Eventually, collaborative learning with peers became the norm in STEM-related courses. For Pamela, peers created a community atmosphere especially in graduate school,

> I became more confident, because as you go through classes with other chemistry majors, it would become a smaller group, so you went through different classes together. It became easier for me the more I went to school. In graduate school you had all these people from different nationalities, so I felt part of a group, we were a group of ethnically different people working on a common goal. Since I had a hard time asking for help during undergraduate school it was a little more difficult than graduate school.

In classroom community, peers often work together to find solutions to homework problems, and/or team up to present research findings. Joseph emphasized the importance of peer collaboration,

> One thing I really enjoyed doing with my friends was going in to a study room with a white board, and one of the guys would write down a problem and we would solve it together. We would do our homework together, and it was really beneficial. We had positive peer pressure to get it done. I did the same thing in my graduate program, working with other officers in my field. We would sit in a room and do math problems. That really helped out. I recall one person did not have the technical background for pilot training; he was terrible at math. We all got together and taught him, and he ended up graduating. Although, I don't remember him saying, hey guys thank you for getting me through this! [laugh]

Both participants agreed that classroom community enhanced their success in STEM subjects. Classroom community progresses into collaborative learning opportunities. Pamela mentioned, "I think that me being successful was important to the groups success." Both also agree that peer groups increased their self-esteem and confidence in STEM-related content.

My experiences, as it relates to this theme, are described below,

> In contrast to the participants, I did not get involved with collaborative learning until I reached my master's degree program. When I enrolled in graduate school biology courses I was not prepared, plus I had to take prerequisite courses concurrently with my graduate degree biology courses. I made one good friend during graduate school, and we studied together from that point on. He was very helpful and held me accountable to meet together for studying. I believe it was beneficial for him as well.

Neither participant engaged in collaborative learning in courses that were not STEM-based. Similarly, I was not involved in collaborative learning in non-STEM courses.

Brevity of Family Influence on Persistence

Both participants had a family member establish their interest in STEM. Pamela observed her mother studying while enrolled in nursing school. Joseph observed his father and grandfather work on different types of engines; he recalls them being very proficient in a practical mechanical sense. However, while the participants' families were generally supportive in their educational endeavors, their parents did not directly guide them into STEM-related fields.

Both participants agreed that mentor and/or peer support was important for being successful in STEM courses as Pamela recalled,

> I have always wanted to please my family. My family would have supported me no matter what I wanted to study, but peers offered a different kind of support than family. I would say they are the same level of support, but in different ways. Peer support was more involved in helping me understand concepts and theories, more cognitive I suppose. My family offered emotional support, so the support is the same but in different ways.

Pamela also recalled negative peer influence on school,

> A lot of my friends didn't really have the opportunity to go to college, or didn't want to go to college. I chose a lot of times to stay and do things with my friends rather than go to school, so I would get behind in school. My friends' future depended on making money, but my future depended on graduating from college. You know, I had enough money to go to school but this barrier was more environmental I would say.

Joseph's family support was also more emotional than cognitive, as he often reflected on his father's general advice "to never quit and to stick it out." He acknowledged that his parents were not heavily involved in his graduate work, since he was independent during that time period. When I asked, "At which level of school did your family show the most support for your interest in STEM-related subjects?" Joseph was taken aback,

> Hmm, wow [pause]. My immediate family, never showed support one way or the other for anything STEM-related. The support for me was watching my dad

> and grandpa's interest in working with their hands. I love my family, but they pretty much left undergraduate school up to me. Maybe it's because they didn't go to college, I don't know. In my graduate program I had a strong relationship with my peer officers. I have said this to many people, that a lot of times your family is not the ones that have a major influence on your ability to succeed. My wife has been very supportive during my Ph.D. program. But, there are people that I met in life that encouraged me and supported me outside of family, such as peers and mentors.
>
> My experiences are similar to the participants, and are described below,
>
> Similar to the participants I did not receive any assistance from family with STEM-related coursework. This is mainly true since I took most of my STEM-related courses at a school located over an hour away from family. My family often provided emotional support, but I felt like it was up to me to persist through a STEM-related graduate degree program. I met my wife during my Ph.D. program, and she was very supportive, my parents also moved closer during this time and provided emotional support as well.

Concerning STEM-related issues, both participants agreed that peers and mentors had a greater influence than family. In fact, both agreed that they had no family assistance with their STEM-related coursework at any level of school. However, both were pleased that they made their parents proud, but ultimately it was mentors and peers that played a pivotal role in their STEM success.

Post-Graduate Involvement in American Indian Community

Both participants realized the importance of AI culture and becoming a positive role model. Throughout their scholastic career, both participants acknowledged culture and heritage as a positive influence to their well being. After graduating with their graduate level STEM degree, they each desire to return to their AI communities as a positive role model. Pamela noted,

> For my present life and work situation, and the older I get the more significant it [culture] becomes. My native culture may be gone in three generations, so I understand that situation, and currently it's important for me to become more involved in culture to help sustain it.

Pamela is currently in the process of returning to school to pursue another STEM degree in the health sciences field with aspirations to give back to the AI community.

Like Pamela, Joseph explained his desire to become more involved in the AI community as well,

> People say, "You didn't learn your language." I've always been proud of who I am. I've always been honest about not growing up in a traditional environment, but it doesn't make me any more or any less Indian. While I was at NASA, I realized the remarkable opportunity I had to make a difference in the lives of AI kids. That is the focus of my Ph.D., education in Indian Country, because I think there is a huge need for it. It's important to point out that your world is really what you make it. When you meet people outside of your experience base it opens your eyes to the possibilities, getting an education makes a difference, it's good for your family and community.

Since Joseph earned his Ph.D., he has made a positive impact in the lives of AI communities. As an example, he met a young AI lady at a conference who informed him that he impacted her decision to pursue an engineering degree when she was 12 years old. She recalled his visit to a college in Colorado where he discussed STEM topics to middle school children.

My experiences as it relates to this theme are described below,

> Before returning to school to pursue a Ph.D. I was a college professor. Most of my teaching years were at locations serving large populations of AIs. With a family history of AI servitude, my mother worked for the Indian Health Services, my father and grandmother at a federal Indian school as a teacher and counselor, respectively. I hope to continue the tradition of community service for AI populations, just as the participants desire to do. However, returning to AI communities was not a driving force for me while pursuing a STEM-related degree nor was it a persistence factor.

AI community involvement was not mentioned as a significant persistence factor in either participant's initial STEM-related education experiences. Yet, their desire to be a positive role model in the AI community has been realized.

Supplemental Findings

During the informal interviews other topics came to the forefront. While these topics are often not the focus in AI persistence literature, it was interesting to see the commonality between both participants and myself. Both participants had limited exposure to other AI students throughout their educational career. Pamela recalled having two or three AI students on average from K-12, one or two in junior high and high school, one or two in college, and one other AI as a chemistry major. Joseph only recalled having one AI classmate until reaching the doctoral level where he recalled two other AI students.

Another issue revealed by the participants was the lack of AI educators at all levels of school. Both participants did not recall having any AI teachers in K-12. Additionally, both lacked AI college professors in general, and both adamantly agreed that they did not have interaction with any AI STEM professors. In fact, when discussing the lack of AI professors at the college level, one participant shared another negative experience concerning destructive comments made by a non-AI college professor about AIs. Doctrine, whether implicit or explicit, goes beyond the classroom, as we see in the above example. Interestingly, while navigating through college, neither participant mentioned using AI counseling services or support programs to assist with any college issues.

While the majority of the data between the two participants was invariant, there were also variant items. First, Pamela claimed that her STEM path was set early in grade school, perhaps as early as kindergarten, as opposed to Joseph whose STEM interest excelled through occupational training and rock climbing after his college

freshman year. Second, Pamela often mentioned that she felt her negative teacher/professor issues might have been related to her AI heritage, whereas Joseph did not feel that negative professor issues in the classroom were culturally related. Third, both of Pamela's parents attended college and earned degrees, and her grandmother also earned her master's degree. In contrast, Joseph's mother earned a degree, but his father and grandparents did not. And last, Pamela remained within one city's school system from grade school through high school, while Joseph moved 14 times prior to graduating high school. With these differences, the main constant between the two participants is being a successful AI with an earned graduate degree in a STEM-related field.

My experiences were different in some areas when compared to the participants. First, I attended junior high and high school with a large number of AI students. Although, my interactions with fellow AI students were often negative since I was often referred to as an "apple." Meaning, I was red (AI) on the outside and white (Caucasian) on the inside. That reoccurring incident eventually drove me away from cultural ceremonies. I also had interactions with two AI teachers in high school, yet neither served as a role model or mentor, and they did not urge me to attend college. My development of STEM-related interest does not align with either participant, as I was not influenced to pursue a STEM-related degree by family members. I pursued STEM, specifically biological sciences, because I felt that I was good in that subject area.

Similar experiences with participants included not having any AI STEM instructors at any level of school. I recall seeing one AI professor during my master's degree program, but I do not recall what he taught. During my Ph.D. program, I

became aware of one additional AI professor. My STEM interest timeline aligns more with Joseph, when I became more interested in STEM during my undergraduate studies, more specifically during my senior year. My negative experiences with teachers align more with Pamela. As an example, in organic chemistry, I wrote "D" as an answer to the matching portion of an exam, and the professor marked it as incorrect, when it was not. His reasoning was my letter D looked like the letter O, but the matching portion did not have the letter O as an option for an answer. It was obvious he did not like me, and I believe it was related to my culture. I dropped out of college during my undergraduate level studies due to my negative experiences and unfamiliar environment associated with the college culture, which was similar to both participants. My parents' educational background aligns with Pamela. However, my grandmother played a more vital role in my desire to attend college.

Discussion

The results of this study provide insight to persistence factors for AI students pursing a graduate level STEM-related degree. The four themes that emerged from two informal interview sessions may provide valuable information for future students interested in STEM-related fields and for STEM-related educators exposed to AIs at all levels of school. The data both agreed and contradicted previous literature as it relates to the general persistence at the college level for AI students.

Family is often at the forefront of persistence factors for AI students (Falk & Aitken, 1984; Guillory, 2009; Guillory & Wolverton, 2008; Jackson et al., 2003; Oosahwe, 2008; Pavel & Padilla, 1993). However, the data from this study differ from those of other studies investigating AI undergraduate persistence factors. One

participant equated peer support equal to that of family support, while the other participant indicated that peers offered more support. Both agreed this to be especially true in the area of STEM-related subject material. A possible explanation for the contradiction to previous research may be that family offers a larger role for persistence at the undergraduate level than at the graduate level and/or with other non-STEM fields of study.

Financial support is another common issue found in the literature involving AI persistence (Falk & Aitken, 1984; Guillory & Wolverton, 2008; Huffman, 2003). Yet, neither participant identified this as a barrier during their postsecondary careers. For example, one participant mentioned adequate financial resources from scholarships and tribal grant programs as a persistence factor. I agree that financial aid is more available for AIs majoring in STEM-related fields. However, financial burdens may become more prominent for AI students who leave their communities (Huffman, 2003), and more so when attending college out of state.

Academic preparation is another barrier mentioned in the literature for persistence in college (Benjamin et al. 1993; Falk & Aitken, 1984; Guillory & Wolverton, 2008; Hoover & Jacobs, 1992; Huffman, 2003). In this study, neither participant discussed academic preparation as a barrier for persistence even though both encountered negative teacher experiences prior to graduating from high school. In my case, college was difficult, mainly due to the lack of academic preparation, which aligns with the literature (Benjamin et al., 1993; Falk & Aitken, 1984; Guillory & Wolverton, 2008). My challenges early in my college career were directly related to a negative

teacher experience in junior high, which is when my desire to enroll in college ready courses ended.

Student and teacher relationships (Falk & Aitken, 1984; Oosahwe, 2008) are sparsely mentioned in AI persistence literature. Both participants emphasized the importance of mentors, especially in the areas of STEM-related education. Mentors serve as confidants for both academic and emotional support, and as an integral part of a professional classroom community. In comparison, mentorships are not uncommon in non-AI communities as Gayles and Ampaw (2011) considered it to be a crucial factor for non-AIs persisting through a STEM-related program. Ironically, the mentors for both participants in this study were non-AI.

The desire to give back to the AI community exists in the literature as a persistence factor for AI students (Larimore & McClellan, 2005; Oosahwe, 2008). According to the participants in this study, they both desire to become more involved within their local and national AI communities. This desire may not have been at the forefront during their undergraduate and master's level of study, but as both participants progressed through their careers it has become their goal. Therefore, I do not believe this theme had any bearing on their persistence during their bachelor's and master's degrees. Likewise to my experience, the desire to give back to the AI community, as a persistence factor, was not realized until after I graduated from my master's program and began teaching at the college level.

Finally, condsidering the findings in this study, the overall implications for AI STEM-related education appears cyclical. As an example, none of the participants were exposed to AI STEM faculty at any level of their educational career. Yet, each

participant agreed that having a mentor was crucial for their success in STEM-related curricula.

Limitations

Since this study focused on AIs in STEM-related fields, a possible limitation is related to the insufficient number of AIs holding a graduate level degree in a STEM-related field. As a result, there is lacking representation of AIs with a history of attending Bureau of Indian Education schools and/or tribal community colleges. Although I invited individuals fitting this criteria, their interest in particaption did not materialize. Ideally, a comparison is needed between successful AI STEM-related graduate degree holders who emerged from two different college prepatory pathways.

Directions for Future Research

The findings of the study reveal the need for future research. I recommend including AIs with undergraduate level STEM-related degrees and comparing them to the findings in this study. I also recommend further phenomenological-based studies in science education to include AIs who attended schools on or near an AI reservation as a comparison to the participants in this study. Future studies could also concentrate more in the area of AI student-mentor relationships, not only in STEM-related programs, but also in other fields of study. Finally, continued research in undergraduate and graduate collaborative learning circles for AI students would provide more clarity for educators and policy-makers, especially those policy-makers who have relied solely on traditional federal guidelines.

Conclusion

Overall, the driving force to succeed in a graduate STEM-related program relied heavily on mentors and peers for both male and female participants. Mentors were a significant influence on Pamela and Joseph reenrolling into college. Mentors also played a crucial role in guiding each participant toward a graduate STEM-related degree program. In addition, peers impacted the participants' experiences as a STEM-related undergraduate and graduate student. Peers helped each participant navigate through STEM course curricula and made a considerable contribution to their success as a STEM-related undergraduate and graduate student. Being interested in a STEM-related field is important, but it may not be the ultimate factor for AIs to pursue a STEM-related degree. As seen in this study, the nurturing aspect provided by mentors and peers at crucial time periods throughout K-20 become vital for AIs interested in STEM-related studies. STEM interest must be rekindled along the way, especially by a mentor who understands the struggles AI students face when entering the independent culture of higher education.

From my own personal experience, it is refreshing to see that two other STEM-related professionals shared personal conflicts related to my own during their school career, and yet persevered to earn a STEM-related graduate degree. My intentions of this study were made explicit in prior sections. Although, I hope this study will open the door to more phenomenological studies in the area of AI education and STEM, I also hope this study creates dialogue with those who agree or disagree with my findings in order to promote more interest in the area of AI STEM-related K-20 education research.

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APPENDIX A: PROSPECTUS

Table of Contents

Chapter 1: Introduction

The history of American Indian (AI) education during the colonial period of the United States and continuing through the 20th Century has been primarily unsuccessful for the AI (Carney, 1999). Historically, the educational goal of the U.S. government was to assimilate the AI into the newly established European culture (Layman, 1942). The government's goal of assimilation not only left AIs with a decreased proficiency in their tribal skills and cultural knowledge, but also with the lack of skills to flourish in the established European society (Reyhner & Eder, 2004). Moving forward to the present-day, AIs are still struggling within the American education system especially when compared to their counterparts.

According to Lundberg (2014), when AIs consider formal education in the United States, their perceptions are shaped by historical and contemporary injustices. While there is much research concerned with AI education in general, there is limited research addressing AI higher education (McClellan, Tippeconnic Fox, & Lowe, 2005). Moreover, there is inadequate research involving AIs successfully completing degrees from United States higher education institutions (Demmert, 2006). Regardless of race or culture, factors that may determine persistence for all groups of students may include, but are not limited to, pre-college academic preparation, financial support, and family support. For the AI, academic preparation for postsecondary education is but one of the critical issues determining persistence (Hoover & Jacobs, 1992).

According to Guillory and Wolverton (2008), several theoretical models have attempted to describe college student retention such as Tinto's (1975) "Theory of Student Departure", which implies that successful college students integrate into the

social and academic life of college. This success is influenced by pre-college background and characteristics. Some researchers believe this theory does not work well within certain cultures. For example, Tierney (1992) asserted the model fails to consider a student's movement from one culture to another, as he states, "… the implicit assumption is that Native Americans will need to undergo a cultural suicide of sorts to avoid an intellectual suicide" (p. 614). Shifting from one culture to another would disrupt any individual's expectations of social and cultural integration (Huffman, 2003), which may have an effect on college enrollment, retention, and completion.

Overall, graduation rates for AIs are less than half of their white counterparts (Bergstrom, 2012) and the lowest of any minority group in the United States (Hunt and Harrington, 2008). Yet, according to Bergstrom (2012), there has been an increase in the number of AIs attending college over the past 40 years. This increase is reflected in AI enrollment in the areas of science, technology, engineering, and mathematics (STEM). Despite the increase in college enrollment generally and STEM enrollment specifically, there still remains retention concerns, especially for women and minorities in STEM degree programs (Whalen & Shelly, 2010). In general, retention in STEM degree programs is low in the United States. In fact, regardless of student demographics the United States is lagging behind other countries in the number of STEM degrees granted at higher education institutions. For example, the National Math & Science Initiative (NMSI) website titled "STEM Crisis" reported during the year 2008, 31% of all United States bachelor's degrees awarded were from the science and engineering fields, compared to 61% for Japan and 51% for China. Furthermore, the NMSI website reported that 38% of the students who start with a STEM major do not earn a degree

within a STEM field. Although the need to increase the number of STEM graduates is desirable for all groups of students, this study will focus on successful AIs who have earned graduate degrees in STEM-related fields.

Background of the Problem

With little research in the area of AI STEM education, this section will include the general background of AI education. Historically, AIs have struggled with obtaining success within the formal U.S. education system. The background for AI education was not education by AIs, but by those of non-AI decent including missionaries, federal employees, and public-school educators (Lomawaima, 1996). Yet, as recent as the early 20th century, education was not the only setback for AIs, extreme poverty, disease and poor sanitary conditions also existed. In 1928 *Merriam Report* was published, which informed Congress of the miserable conditions within AI societies. The *Merriam Report* influenced a change in the theoretical focus of the government by moving away from the destruction of AI language and culture to a more inclusive AI influence (Juneau, 2001). Later, the Indian Reorganization Act of 1934 eventually shifted the purpose of AI education from acculturation towards self-determination (Carney, 1999). This shift in methodology allowed AI tribal leaders to provide input into the education of their children (Reyhner & Eder, 2004). Moreover, the self-determination era (1969-1989) considerably empowered AI tribes by giving them more involvement in policies that influence their tribal members and the tribe itself (Walch, 1983). However, it was not until the decade of the 1960s and the establishment of tribal colleges that educational goals began to focus on preserving language and culture (American Indian Higher Education Consortium, 2014).

In general, the history of AI higher education has very few positive examples of triumph. One example is the development of the AI tribal college system, which introduces AI culture into the curriculum. Regardless of the AI college movement, AIs are still struggling within the U.S. higher education system. According to Bergstrom (2012), low retention rates in higher education have persisted throughout AI history. Moreover, significant underachievement continues in post-secondary institutions for AI students regardless of the positive gains in federal policies and education reform (Hunt & Harrington, 2008). Even with low numbers of successful AIs in higher education, Glenn (2011) acknowledged that formal United States education is something desired by AI parents for their children. Still, in education there remains a void of AI mentors, especially in the areas of STEM education (Herrington, 2014). Perhaps, Deloria's quote was correct when he stated, "The thing that has always been missing in Indian education, and is still missing today, is Indians" (Deloria & Wildcat, 2001, p. 152).

Purpose of the Study

The purpose of this study seeks to explore factors that influenced AI students' interest in STEM-related fields and to examine how AIs successfully persist through the U.S. educational processes required to earn graduate degrees (e.g., M.S., and/or Ph.D.) in STEM-related fields. Identifying and understanding strategies that assisted successful AIs during their scholastic careers (K-graduate school) may be valuable in three areas. First, college bound AI students will be more aware of strategies used by other successful college graduates. Second, educators in areas that serve AI students can identify and/or implement positive events that encourage students to pursue a STEM degree and ultimately remain in school. And finally, higher education institutions and

their staff can better assist and alleviate obstacles that AI students may encounter while engaged within their STEM curriculum of study. Therefore, the following questions will guide this study:

Research Questions.

1. What are the factors that influence AIs with a STEM-related degree to become interested in science?
2. What are the factors that allow AIs to complete a graduate degree program in a STEM-related field?

Description of the Study

Past studies exist exposing valuable information concerning AIs and their higher education experiences (Adelman et al., 2013; Benjamin, Chambers, & Reiterman, 1993; Falk & Aitken, 1984; Guillory & Wolverton, 2008; Jackson, Smith, & Hill, 2003; Oosahwe, 2008; Pavel & Padilla, 1993; Tierney, 1992). Of these studies, Benjamin et al. (1993), Jackson et al. (2003), and Oosahwe (2008) focused explicitly on student success. This study is guided by a similar qualitative method used by Oosahwe (2008) who focused on "strategizing success" of AI higher education students. In the Oosahwe (2008) phenomenological study, she utilized a narrative approach to seek out the experiences of AIs during their higher education careers. Whereas, Benjamin et al. (1993) used a mixed method approach, and Jackson et al. (2003) utilized a philosophical foundation based on relational ontology. Although, the Oosahwe (2008) study focused on higher education success in general, this study will focus purposely on the successes of AIs who earned graduate degrees in STEM-related fields.

Purposive sampling will be used to identify approximately six participants; this will ensure the population being studied meets the research parameters (Silverman, 2005). The criteria for participant selection are: (a) having an earned graduate degree in a STEM-related field from an accredited U.S. higher education institution; (b) being a member of a federally recognized tribe; and (c) self-identifying as an AI while pursuing a graduate degree. Participants will be pre-screened through email and phone conversations to determine interest. A formal participation and consent agreement will be sent to those willing to participate in the study.

A qualitative research design using a phenomenological narrative approach was selected for this study to capture and identify AI graduates' life experiences and how these experiences relate to their successes. The phenomenological method seeks to understand the essences and meanings of human experiences by utilizing open-ended questions (Moustakas, 1994). Identifying detailed life experiences of few individuals is most effectively accomplished using a narrative approach (Creswell, 2009), which gives access to individual's experiences in the context of time, order, and change (Sandelowski, 1991).

The research query guiding this study is interested in two major areas: (a) determining how and when successful STEM degreed AIs became interested in science, and (b) the factors that have allowed these particular AIs to complete their graduate STEM-related degrees. These two areas will be the focus of open-ended questions presented to the participants using written formats and face-to-face interviews. Prior to interviews, demographic questions concerning age, gender, degree type, highest degree attained, and familial education history will be asked to allow the researcher to gain a

better understanding of the participants. Participant interviews will be a key component of this study, as Kvale and Brinkman (2009) argued, interviews allow the researcher access to the participant's view of the world and their lived experiences. A predetermined list of open-ended questions and topics will be used for data collection to ensure consistency and avoid leading questions by the interviewer. The following primary interview questions were modified from previous studies (Bergstrom, 2012; Guillory, 2009; Oosahwe, 2008) to focus on STEM content:

1. When did you become interested in STEM-related education?
2. What event(s) and/or people influenced your interest in STEM fields?
3. Describe any barriers you encountered during your K-12 level STEM coursework/training.
4. Describe any barriers you encountered during your undergraduate level STEM coursework/training.
5. Describe any barriers you encountered during your graduate level STEM coursework/training.
6. Describe factors that aided in the completion of your STEM-related graduate degree.

Follow-up questions will be developed after analysis of the participants' initial responses to increase the understanding of the their lived experiences. Transcripts and/or audio recordings of participant interviews will be interpreted and coded using a phenomenological approach. The exploration of the participant's responses will follow Yin's (2011) five phases of qualitative data analysis: (a) compiling data; (b) disassembling and assigning codes; (c) reassembling codes and themes; (d) interpreting to create narratives; and (e) concluding while considering all phases. During data analysis themes will be identified and compared to prior research findings.

Follow-up questions will occur via phone conversations and/or e-mail followed by a second round of analysis. E-mail will be used due to participants' distant location from the researcher. According to Creswell and Clark (2011), e-mail has become a viable tool for interview data collection. After each interview analysis, member checking for efficiency will validate the interpretations of the participants' experiences. These qualitative methods will be used to identify events that lead up to interest in STEM-related fields and to determine which factors commonly occur between successful AI STEM graduates.

The alternative research method is a quantitative research design involving relationships between variables that can be statistically analyzed. When compared to a qualitative design, quantitative methods rely more on the researcher's interpretations to a social or human problem (Creswell, 2009). Therefore, a possible weakness for a quantitative study is that the participant's voice goes unheard (Creswell & Clark, 2011). Thus, using a qualitative method for this study will give a better understanding of the challenges and strategies of AIs successfully completing graduate college degrees in STEM-related fields.

Prior to conducting any data collection, approval from an authorized institutional review board (IRB) will be attained from the University of Oklahoma. Later, an invitation to participate in the research project will be sent to each potential participant with specifics such as the background of the researcher, school affiliation, and expected time to participate in interviews (Rudestam & Newton, 2007). Initial question delivery will be conducted via face-to-face interviews followed by secondary questions utilizing electronic mail (e-mail), phone interviews, or a combination of both.

These options will allow convenience for the participants who may be located in different areas of the United States.

Definitions

1. American Indian – There are several terms that may be used in the literature to describe the indigenous people of North America. These include: Native American, Indian, North American Indian, Alaskan Native, or their specific nation such as: Chickasaw, Comanche, Navajo, Otoe-Missouria. For this particular study, an American Indian includes both male and female members of a federally recognized tribe of the United States.
2. STEM-related graduate degree – This term will include degrees that are in a STEM field or those fields that are directly related to a STEM field including degrees with a focus in education such as: science education or mathematics education. Therefore, a Masters of Education, Masters of a specific STEM field, Doctorate of Education, or Doctorate of Philosophy within a STEM field may all be included.
3. Higher Education Institutions - This term is defined as an accredited postsecondary education institution both public and private, including tribal colleges, community colleges, four-year institutions, and research institutions.
4. Assimilate - This term is defined as a cause or event leading to a culture change of one population to that of another population.

Limitations

I am member of the Otoe-Missouria tribe of Oklahoma and is also affiliated with the Comanche tribe and Kiowa tribe of Oklahoma. Additionally, the researcher has experience pursing and attaining a graduate STEM-related degree. Researcher bias involving a qualitative method may be considered a possible limitation to this study (Creswell & Clark, 2011). Therefore, to eliminate bias, participants will verify the researcher's interpretations prior to forming conclusions. Another limitation tied to qualitative data collection is the use of open-ended questions. Open-ended questions may yield unforeseen reactions by the participants, thus finding patterns within the data are often seen as difficult (Rudestam & Newton, 2007). Therefore, a senior researcher will review transcripts and follow-up questions created after the initial participant interviews, as well as member-checking of responses by the participants to ensure validity.

Another limitation involves the location of participants. According to Yin (2011), face-to-face interviews are ideal since they may reveal more information such as gestures and social interactions. While this study utilizes an initial face-to-face interview, it will rely secondarily on phone and/or e-mail correspondence for follow-up questions. It is assumed that since the participants have attained a high level of education they will provide adequate and valuable information about their education careers through these phone interviews and/or e-mail.

Another possible limitation is the exclusion of other degrees earned by AIs. Therefore, the findings may not be representative of every individual North American tribe in every academic setting. Again, this limitation is related to the proximity of

research subjects and the number of different tribal nations in North America. This limitation also relates to the diversity of AIs focusing in other academic fields. Unfortunately, this study does not include other successfully degreed AIs in different fields and at different degree levels. In future research, a comparison at different education levels and fields may provide additional information.

Chapter 2: Review of the Literature

The history of Western education for American Indians (AI) originated with missionaries with the goal of converting them to Christianity and ultimately assimilation into the new European culture (Reyhner & Eder, 2004). As Glenn (2011) asserted, "There can be no question that the colonists also hoped that adoption of Christian beliefs and the associated (as Europeans understood them) behaviors would make the native peoples more tractable" (p. 19). Additionally, Ogbu (1987) claimed, that cultural differences become evident when two different populations meet, especially when one culture dominates over the other, thus a struggle ensues to maintain ones own culture while exposed to another. Regardless of AIs desire to maintain their own culture, the main objective of the U.S. government was to civilize the Indian (Layman, 1942). The results for a quick assimilation using missionaries, and later use of boarding schools were unsuccessful. Those assimilated were left lacking in cultural skills and knowledge needed in their home community but also the fundamental skills necessary to flourish in U.S. non-Indian communities (Reyhner & Eder, 2004).

During the late 1800s and early 1900s, higher education institutions in the United States increased. This increase typically served women and other minorities, while excluding the AI (McClellan et al., 2005). When the history of AI higher education is considered, a vocational theme is typically at the forefront (Deloria & Wildcat, 2001). It was not until the 1960s that AI college enrollment began to see a significant increase (Carney, 1999). In 1968, the Navajo nation opened a community college that integrated native culture into the curriculum. The opening of the Navajo Community College (NCC) is often considered a true beginning of AI self-

determination and a shift away from the U.S. government (Bureau of Indian Affairs) run schools (Crosby, 2011; Juneau, 2001).

Since the opening of NCC in 1968, higher education for AIs has made tremendous progress. Yet, today there remains low representation and low graduation rates at postsecondary institutions (Shotton, Oosahwe & Cintrón, 2007). According to Stephens, Fryberg, Markus, Johnson, and Covarrubias (2012), college is an expected part of life, and symbol of independence for people socialized in middle-class America. Unfortunately, AIs typically come from the poorest class of American people (Bowker, 1992). Additionally, Bergstrom (2012) noted that accessibility due to location and AI lifestyles as major barriers for AI students entering higher education institutions.

It has been documented in the literature that AIs have low numbers of postsecondary attendance and low graduation rates (Adelman, Taylor, & Nelson, 2013; Benjamin, Chambers, & Reiterman, 1993; Falk & Aitken, 1984; Guillory, & Wolverton, 2008; Jackson, Smith, & Hill, 2003; Oosahwe, 2008; Pavel, & Padilla, 1993; Tierney, 1992), but recently AIs are starting to recognize that a college degree can provide positive change for themselves and the AI community (Oosahwe, 2008). Hunt and Harrington (2008) called education the "quintessential social equalizer" (p. 2). Thus, it is imperative to understand how some AIs persist and graduate successfully. According to Huffman (2003), further research is critically needed in the area of personal accounts of AI college students. Past research has focused mainly on students who are currently enrolled in undergraduate programs, when it is equally as vital to understand how AIs earn graduate degrees. This study will focus on successful AIs who

have earned a graduate degree, specifically in STEM-related education, since there are low numbers of graduates within this field regardless of culture.

It is important to understand a broader context of the relationship between AIs and the U.S. government's formal educational system (McClellan et al., 2005). Hence, this chapter will address two major areas related to AI education. The first section will briefly address the history of AI education. As Pewewardy and Frey (2004) argued, one cannot examine higher education for AIs until they scrutinize the history of United States' federal policies. This is particularly true since the history of formal education in the United States has been shaped by oppression and injustice (Lundberg, 2014). The second section will focus on literature pertaining to AIs relationship within the U.S. higher education system. There are various examples of research concerned with AI education, but AI higher education has considerably less representation in scholarly literature (McClellan et al., 2005). Additionally, there is an uncertainty about the forces and factors that allows an AI student to persist through postsecondary institutions (Larimore & McClellan, 2005).

Body of the Review

Historical Overview. The U.S. government's desire for quick assimilation of the AI into the newly founded European culture using missionaries and boarding schools was vastly unsuccessful (Pewewardy & Frey, 2004). Thus, a historical review is valuable and relevant to understanding how the early settlers interacted with AIs during the development of the United States (Anderson, 2012). Furthermore, a review ultimately clarifies the influence of the dominant culture on AI K-college education.

Researchers and historians group events between the AI and the U.S. government into various eras (Carney, 1999; Juneau, 2001; Reyhner & Eder, 2004). Each of these researchers identified common overlapping time frames grouped as the colonial era, federal era, and an era of self-determination. While this section will incorporate historical events from research done by the above mentioned researchers, it will pay closer attention to the more detailed time frames of Reyhner and Eder (2004). It should be noted that to completely summarize the history of AI education, especially considering all the different tribes of AIs, their education prior to, during and after the arrival of the first Europeans would be difficult (Layman, 1942). Therefore, the following section will focus on major events recounted by most historians as being significant influences within AI education with an emphasis on higher education, followed by a second section that will focus specifically on retention/persistence and successes within AI higher education.

Colonial missionaries and their schools (1492 - 1776). The newly founded American society sought to convert and assimilate AIs into Western society through institutional education of AIs (Glenn, 2011). During the colonial period, a common teaching method for AIs was repetitions of religious instruction (Reyhner & Eder, 2004). Other formal educational activities during this time period were agricultural and industrial in nature (Layman, 1942). While the focus for educating AIs was based primarily on religion and vocational studies, AIs were often included in charter statements of higher education institutions in the United States. For example, Harvard, the College of William and Mary, and Dartmouth included AIs in their charter statement (as cited in Carney, 1999, p.1):

> [The purpose of Harvard College are] The advancement of all good literature, artes, and sciences. The advancement and education of youth in all manner of good literature, Artes, and Sciences. All other necessary provisions that may conduce to the education of the English and Indian youth of this Country in knowledge; and godliness. Harvard College Charter, 1650
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> [William and Mary College has among its purpose] that the Church of Virginia may be furnished with a seminary of ministers of the Gospel, and that the youth may be piously educated in good Letters and Manners, and that the Christian faith may be propagated amongst the Western indians, to the Glory of Almighty God. William and Mary College Charter, 1693
>
> [Dartmouth College would exist] for the education and instruction of youths of the Indian tribes in this Land in reading, wrighting, and all parts of Learning which shall appear necessary and expedient for civilizing and Christianizing Children of Pagans as well as in all liberal Arts and Sciences; and also of English Youth and any others. Dartmouth College Charter, 1769

However, between these three colleges and during 240 academic years there were only forty-seven AI students in attendance, with only four AI students graduating (Carney, 1999). Thus, AIs struggled with higher education persistence from the onset. Nonetheless, AI higher education was at its peak during this era and would not see equal interest until the mid-twentieth century, and the U.S. higher education system continued to reflect the dominant society's rituals and mores, while neglecting to consider the culture and background of AIs well into the twentieth century (Tierney, 1992).

During this era, two items of interest began and remained controversial for many years to come. First, questions arose of whether to teach AIs the best of their own culture or that of the white man's, and second, whether to teach AIs in their own community or somewhere distant (Layman, 1942). The early missionary belief was that AIs must remain in one definite place; subsequently, it became policy to discourage the nomadic lifestyle of AIs. As a result of this policy, the theme for residential type

schools became common in 1754 when a boarding school was established in Lebanon, Connecticut (Glenn, 2011).

Treaties and Western Removal (1776 - 1867). During and after the American Revolution, radical changes occurred between the AI and the U.S. government (Carney, 1999). Since the war was fought against the British what would AIs do during and after the war? During the American Revolution, the American colonist wanted AIs to fight with them or at least stay neutral (Reyhner & Eder, 2004). Therefore, during this era, peace with AIs was a goal of the U.S. government, but it was often impeded by the desire for Indian land by white settlers (Glenn, 2011).

In 1789, the U.S. War Department was established and all matters of Indian affairs became its responsibility. The mission to assimilate AIs continued, and with the support of President Washington and Thomas Jefferson, the first promise to provide education to AIs occurred in 1791 followed by the first treaty involving education in 1794 (Layman, 1942). Years later, Congress passed the Indian Removal Act of 1830, which authorized President Andrew Jackson to exchange lands in the west for those held by AIs in the east (Reyhner & Eder, 2004). In 1838, the infamous Trail of Tears removed AIs from their homelands in the east to lands west of the Mississippi River. However, after their removal, the perseverance of AIs surfaced. As an example, the Cherokee established their own school system in 1841, and while the colonial era curriculum was dedicated to religion and the English language, there was a curriculum shift in the Cherokee school by developing a more comprehensive system to include other subjects. Cherokee schools taught reading, writing, arithmetic, bookkeeping,

English grammar, geography, and history, and within 10 years, locally trained teachers replaced eastern-educated missionaries (Reyhner & Eder, 2004).

Likewise, the Choctaw developed their own education system with the assistance of grants for land relinquished to the government. In 1834, after the Choctaw removal, the Choctaw Academy enrolled 156 students including, 62 Choctaws, 24 Pottawatamies, 15 Cherokees, 15 Creeks, 8 Miamies, 8 Seminole, 4 Quapaws, and 20 Prairie du Cheins (Reyhner & Eder, 2004). Overall, during this era, courses offered moved away from a religious foundation to a more comprehensive curriculum including subject areas of astronomy, natural philosophy, moral philosophy, geography, and vocal music (Reyhner & Eder, 2004).

While the success of the Cherokee and Choctaws was being established, the first U.S. government treaty involving higher education for the AI occurred in September 1830 within the Choctaw Nation (McClellan et al., 2005). The funds to operate higher education came from the U.S. government, treaty provisions, religious groups, and the tribes themselves (Carney, 1999). However, after 1848, the typical education for AIs specified in treaties was of an agricultural and industrial school type (Layman, 1942). In fact, what Carney (1999) considered the "Federal period" (1778-1934) the government did not support any formal higher education institutions for AIs. However, during the late 1800's and early 1900's, colleges for women and other minorities began to flourish (McClellan et al., 2005). Yet, the newly formed minority colleges conformed and integrated the dominant society's cultural beliefs to meet certain American standards and accreditation requirements (Tierney, 1992).

Reservations (1867 - 1887). When General Ulysses S. Grant became president in 1869, the desire for peace continued with AIs. Meanwhile, the transcontinental railroad was being completed. This meant more immigrants moving westward with a desire for land (Carney, 1999). The desired separation of AIs from whites shifted. Instead of moving AIs to the unsettled west, segregation onto reservations became the norm (Glenn, 2011). Once settlement onto a reservation occurred, AIs required paperwork to leave reservation boundaries. During this era, AIs became a ward of the U.S. government (Reyhner & Eder, 2004). This event set the stage for more boarding school openings. In 1860, on-reservation boarding schools were established and in 1879 off-reservation boarding schools were formed (Juneau, 2001). The Carlisle Indian School became a classic example of an off-reservation boarding school system when it opened in Pennsylvania in 1879.

Federal policy of forced assimilation, the suppression of AI language and culture continued throughout this era, and yet, AIs were still not considered U.S. citizens (Reyhner & Eder, 2004). The history of U.S. government treatment of AIs has caused distrust of the U.S. educational school system, which still persists within AI communities (Lundberg, 2014). Moving AI children from their home to attend boarding school remained prominent into the twentieth century. Only two higher education institutions geared specifically towards AIs opened during the end of this era; Bacone College in Oklahoma was established in 1880, and Pembroke State University in North Carolina was established in 1887. However, neither school received federal support (Reyhner & Eder, 2004).

Allotment and dependency (1887-1924). According to Carney (1999), the Dawes Severalty Act of 1887 was to remove lands from tribal control and separate the structure of tribes so individual AIs could be assimilated into the non-AI society. The Dawes Act allotted lands in designated quantities: 160 acres to each family head, 80 acres for each person over 18 years including orphans under 18, and 40 acres to each person under 18 (Juneau, 2001). Overall, the Dawes Act produced hardship on AI tribes and families through community separation. As an example, four middle-aged AI sons received land 50 miles apart and 100 miles from their 70-year-old grandfather; this made it nearly impossible to care for each other in their mutual traditional ways (Reyhner & Eder, 2004).

During this era, boarding school enrollment continued to increase, and subsequently Estelle Reel (non-AI) became the U.S. superintendent of Indian schools (1889-1910). She eventually developed the *Uniform Course of Study* (UCS) for Indian schools. The UCS was thought to be racially motivated, since she felt that AI children could reach the same goals and attainment of their white counterparts (Lomawaima, 1996). She believed that white students should prepare for college during their public school career, and AIs should prepare for a vocational trade (Reyhner & Eder, 2004). Her legacy lived on to shape the AI boarding school education system.

During this era, the educational assistance programs carried out by the Office of Indian Affairs included five school types: 1) public schools where the government pays tuition for Indian children; 2) community day schools; 3) reservation boarding schools; 4) non-reservation boarding schools; and 5) contract schools (Layman, 1942). Furthermore, the commissioner of Indian Affairs reported 25 boarding schools, 81

reservation day schools, 147 day schools, 22 public schools, 32 contract schools, and 22 missionary schools serving AI populations, with the highest enrollment for AIs in the reservation day schools (Carney, 1999). In the commissioner's report, there was no mention of AI colleges or colleges serving AI populations. With the history of forced assimilation, AIs were aware that success in college meant an acceptance to the newly formed American society; hence, few AIs desired to attend American colleges (Carney, 1999).

A New Deal (1924 - 1944). On June 2, 1924, Congress passed the Indian Citizen Act. Two years after AI citizenship and thirty-nine years after the skeptical Dawes Act of 1887 a privately funded investigation called the *Merriam Report* focused attention on the dismal conditions of the AI (Juneau, 2001). According to the published *Merriam Report* in 1928, the following conditions of AIs included extreme poverty, bad health, poor sanitary conditions, high infant mortality rate due to disease, insufficient incomes, lack of adjustments to social and economic conditions, and little knowledge of money and land. The federal government's desire for AIs to become assimilated into the newly founded American society continued to fail.

Through the recommendations of the *Merriam Report* under president Franklin D. Roosevelt, the Indian Reorganization Act was passed in 1934. According to Reyhner and Eder (2004), this act ended the allotment of Indian lands, provided religious freedom, limited tribal self-government, government funds for education, health care, and Indian preference hiring practices for Indian service employees. Although there was a desire to improve education for AIs it came to an end when World War II (1939-1945) shifted funds from domestic programs to the war effort. However, after the war, AIs

eventually began using the GI bill to enter mainstream U.S. higher education institutions (McClellan et al., 2005).

Termination and Relocation (1944 - 1969). In Juneau's *A History and Foundation of American Indian Education Policy* (2001), Dr. Willard Bill asserted, "The government continued to withdraw services during the 1950s. In 1952, the Bureau of Indian Affairs closed all of its federal schools in Idaho, Michigan, Washington, and Wisconsin" (p. 36). According to Walch (1983) a solution for the "Indian problem" was to terminate reservations as a means to force assimilation of the AI people. In 1954, the Menominee reservation was the first reservation terminated by the U.S. government (Reyhner & Eder, 2004). However, educated AIs began to have a deeper involvement in the direction of their people. Leadership development through education increased AI tribes' capabilities to deal with the government. Eventually, opposition to termination became a unanimous feeling among Indian people (Reyhner & Eder, 2004).

During this era, there was an increase in AIs attending K-12 school. This increase was possible because schools with AI student enrollment received funding from federal Johnson O'Malley (JOM) contracts. JOM monetarily assisted AI students attending public schools (Carney, 1999). Eventually, more AI high school graduates began entering college, thus the Bureau of Indian Affairs established a college scholarship program in 1948 as well as tribal monetary support for their members to attend college (McClellan et al., 2005). The additional interest in AI higher education continued, and in 1959, Arizona State University established the Center for Indian Education, and eventually started the *Journal of American Indian Education* in 1961 (Reyhner & Eder, 2004). These events differed significantly from those occurring

during 1930s-1960s when the U.S. government's focus for AI higher education concentrated mainly on vocational training (American Indian Higher Education Consortium, 2000).

Self-Determination (1969 - 1989). A 1969 report titled *Indian Education: A National Tragedy, a National Challenge* (Kennedy Report) was conducted, and, in his foreword, Senator Edward Kennedy acknowledged the high dropout rates of AIs. The level of achievement was 2 to 3 years behind their counterparts, and the longer they stayed in school the further they lagged behind (Reyhner & Eder, 2004). Additionally, the report showed that one-fourth of elementary and secondary teachers preferred not to teach AI children.

In the following years, President Richard Nixon insisted on a new era in which AIs determined their own future, and the first new policy of self-determination was the Indian Education Act of 1972 (Rehyner & Eder, 2004). During the self-determination era, the United States enacted major programs to assist AIs including: the Indian Civil Rights Act in 1968, the Indian Education Act in 1972, and the Tribally Controlled Community Colleges Act in 1978 (National Education Association, 2005). A common theme embedded within these policies was the desire to right the wrong against AIs. Yet, problems in education still remained. For example, in 1991, an Audit Report of the U.S. Department of the Interior's Office of Inspector General revealed that AI students in Bureau of Indian Affairs (BIA) schools still fell behind their non-Native counterparts, possibly due to an inferior-quality of education when compared to public schools.

Eventually, AI higher education involvement gained momentum towards the end of the termination and relocation era and the beginning of the self-determination era. In

1968 the Navajo Community College (Diné College) was established; it was the first tribally controlled college administered by a tribe for their tribal members (McClellan et al., 2005). Between 1968 and 1978, seventeen more tribal colleges opened their doors. In 1999, there were twenty-eight tribally chartered colleges and three federally chartered Indian colleges located in twelve states (Reyhner & Eder, 2004). The three federal colleges include the Institute of American Indian Arts in Santa Fe, NM, (founded in 1962), Haskell Indian Nations University in Lawrence, KS (founded, 1970), and Southwestern Indian Polytechnic Institute in Albuquerque (founded in 1971). According to Carney (1999), these colleges were the first degree granting institutions provided for AIs by the U.S. government.

In 1973 AI tribal colleges founded the American Indian Higher Education Consortium (AIHEC). AIHEC serves as an advocate for AI tribal colleges and universities. In 1989, the American Indian College Fund (AICF) was founded. AICF is privately funded to assist students and tribal colleges (Carney, 1999). Presently both entities are still involved in AI higher education.

New Directions in Indian Education (1989 - 2003). The 1990s proved to be a monumental era for AIs as evidenced by the establishment of the Native American Language Act of 1990, the U.S. Secretary of Education's Indian Nations Task Force in 1990, and the White House Conference on Indian Education in 1992. The Native Languages Act served to reverse the policies of suppressing the Native languages in schools, and the Task Force created goals for Indian Nations including more parental, community and tribal involvement, lifelong learning opportunities, high-quality personnel and early childhood programs (Reyhner & Eder, 2004). The White House

Conference issued resolutions to increase federal funding assistance to both tribal colleges and AI students (Carney, 1999). On January 8, 2002, President George W. Bush signed the No Child Left Behind Act of 2001. Additionally, in 2002 the Bush administration developed a plan to privatize BIA schools. According to Reyhner and Eder (2004), AI leaders believed the Bush administration was reverting back to the termination agenda of the 1950s with the intention of reducing government trust responsibilities to educate AI children.

While AIs continue to persevere, they still face government policies of the past and present. In Juneau's (2001) *History and Foundation of American Indian Education*, Raymond Cross assigned the term "three-legged stool" to describe the desired relationship between the U.S. government and AI education. One leg is the accurate representation of AI in public education curricula, the second is the trust obligation to provide education to the eligible AIs, and the third is self-determination applied to tribal education for conservation of culture and natural resources (Juneau, 2001).

American Indian Higher Education Overview. Historically, AIs have been "pushed and pulled" into the dominant culture for the past five-centuries (Deloria & Wildcat, 2001). As a result, research implies that many AI parents have negative views towards the formal education system in the United States (Adelman et al., 2013). Yet, research has shown that the AI students' families are an integral part for success in postsecondary institutions (Benjamin et al., 1993; Falk & Aitken, 1984; Jackson et al., 2003). However, the influence of family may be an obstacle that hinders AIs from attaining a college degree. The families may ask students to return home for tribal ceremonies or assist with family matters, these events may cause excessive absence

from college classes. It is documented in the literature that AIs face significant barriers to education not encountered by their counterparts. (Hoffman et al., 2005).

Theoretical models have served to describe college retention/attrition for the general population of students such as Tinto's "Theory of Student Departure" where academic, institutional, and social commitments by the student are essential for limiting a student's "departure" from college (Tinto, 1975). While some researchers agree with Tinto's model, Tierney (1992) questioned how Tinto's model relates to AIs. Tierney (1992) specified that some cultures do not have the option of "departure" when going through a rite of passage, and therefore "departure" is not a concept that is universal, but it is developed by the society that utilizes this type of ritual. Furthermore, Tierney (1992) claimed that rituals of transitions have not been conceptualized as movements from one culture to another; therefore, when an AI enters a mainstream university, that institution is culturally distinct from the AI's own background and culture. For example, no one would assume a Sioux youth would feel comfortable participating in an initiation ritual and ceremony geared towards a Navajo youth; yet, Tinto's model assumes that this same Sioux youth will feel comfortable going through the Anglo's higher education ritual (Tierney, 1992).

Although struggles exist within all populations of students entering U.S. higher education institutions, AI students persistently produce the lowest graduation rates of any groups of American students (Hunt & Harrington, 2008). And, even though studies exist concerning AI retention at higher education undergraduate levels, Adelman et al. (2013) indicated that AIs are the least represented student group in graduate degree

programs. Therefore, identifying factors that have allowed certain members of AIs to earn graduate degrees would be a beneficial addition to existing literature.

Retention/Persistence of AI Students. When AI students dropout from higher education institutions, it not only causes adverse conditions for the individual, it also affects their families and their communities (HeavyRunner & DeCelles, 2002). In general, student departure from postsecondary institutions is not an uncommon phenomenon. But, for AI students, challenges exist at non-tribal colleges that would not normally exist for mainstream students (Bergstrom, 2012). As a result, AI retention rates at higher education institutions remain extremely poor (Pewewardy & Frey, 2004).

Tinto (1975) argued that a students' background influences their experiences during college. While Tinto's model (1975) has been well accepted it has also been criticized when applied to AIs (Tierney, 1992). Nonetheless, Pavel and Padilla (1993) examined Tinto's model to see how it fits with AI student data. The data for the research participants were drawn from the National Center for Education Statistics' *High School and Beyond*, a national longitudinal database of sophomore and senior cohorts from 1980 to 1986. The statistical method of structural equation modeling was used, and after fitting the model to both the sophomore and senior cohorts, the most important variables for AI student retention were family background, postsecondary intentions, and formal and informal academic integration (Pavel & Padilla, 1993). The most significant factor prior to attending college for both groups was family background. Overall, the model was a modest fit using AI data, which means other factors outside of Tinto's model could be influencing retention and postsecondary outcomes (Pavel & Padilla, 1993).

The findings of Pavel and Padilla's (1993) research support previously published literature by Falk and Atkins (1984), in which they suggested creating programs that foster family support, and the increase of college participation to improve transition to the college lifestyle. Pavel and Padilla (1993) emphasized the need for support programs that eliminate homesickness for AI students, thereby creating a positive environment while at higher education institutions. These recommendations should assist the AI student by providing a positive coping strategy while away from home.

Moving away from home is a challenge for all incoming freshman, but it is especially difficult for AI students (Demmert, 2006). College is often viewed as an unsupportive situation for AIs (Carney, 1999). According to Guillory and Wolverton (2008), mainstream colleges and universities have historically struggled to accommodate AI students. Programs that are created to support AI students are often geared towards integrating the student into the college culture, both socially and academically (Bergstrom, 2012).

In a multiple case study-like approach consisting of two stages, the within-case and cross-case analysis, Guillory and Wolverton (2008) explored similarities and differences between AI student perceptions and the perceptions of various administrations and faculty focusing on factors for persistence and barriers to degree completion at various colleges in the Northwest. Qualitative information was gathered, and the researchers interpreted the information examining processes and outcomes that are common across the cases. The participants included Native American students, state representatives, presidents, and faculty. In this study, the term "institution" referred to

state employees who have potential to impact Native American students attending their universities in Washington, Idaho, and Montana (Guillory & Wolverton, 2008).

Institutions and students were asked to identify three or four "most important" factors that helped AIs persist, and secondly, for the barriers that must be overcome to complete a degree program. The findings by Guillory and Wolverton (2008) identified the most prevalent persistence factors identified by the institution group were financial support and academic programs (i.e. bridge programs). Inadequate financial resources and the lack of academic preparation were the barriers to complete a degree program for AI students. In comparison, the student groups identified persistence factors as family, giving back to the community, and social support on campus; whereas, the barrier factors identified included family, single parenthood, academic preparation, and financial support. Of the above-mentioned persistence factors, family was the most frequently used by AI students (Guillory & Wolverton, 2008). The importance of family aligns with previous research by Jackson et al. (2003) where family was identified as an important factor for persistence.

Independence is the culture of higher education institutions rather than interdependence, and for this reason it is often encouraged by college staff (Stephens et al., 2012). Accordingly, Falk and Aitken (1984) included college personnel in their study of AI student persistence. Falk and Aitken (1984) used a systematic and objective method to determine the perceptions of college for AI students and personnel from several colleges and universities in the Midwest. A mixed method approach was used, first by interviewing 125 students and 11 college personnel, and second, applying Spearman correlations to determine factors that increase/decrease AI student retention.

The interviews sought information in the following areas: academics, family and community, experiences in college, factors promoting or hindering success, and general background of the AI students. Additionally, educators were asked about the factors they feel help or hinder the AI students.

Reyhner and Eder (2004) indicated that many successful AI college graduates had unsuccessful pre-college careers, and that attending college was often not encouraged. Moreover, in Falk and Aitken's (1984) study concerning pre-college experiences, 80% of the respondents indicated that they received no information during high school in the areas of career goals, college expectations, and how to budget funds. In contrast, 21% indicated they were sufficiently prepared for college level work, while 76% reported that they were only somewhat prepared or not prepared at all. Furthermore, after applying Chi Square and Spearman correlation analysis, Falk and Aitken (1984) reported that more years of school completed by AIs was positively correlated with having career goals, parents who supported their field of study, and parents who supported them financially. In similar fashion, years of retention were related to the parent's years of education for the mother and father. To further support the importance of family, Larimore and McClellan (2005) indicate that the student's background is often a good indicator for educational commitment.

Being a culturally competent higher education institution is important to meet the needs of different cultures (Demmert, 2006). Positive interactions between the university and the AI student lead to an increase in student retention (Guillory & Wolverton, 2008). Therefore, it is important to identify the perceptions of AIs by college staff. According to Falk & Aitken (1984) college educators indicated three

primary areas of concern for AI student retention: (a) good academic preparation, (b) personal motivation, and (c) financial support. Additionally, the lack of personal motivation and the lack of academic preparation in high school also received high ranking for AI student obstacles (Falk & Aitken, 1984).

In the aforementioned study, there were two particularly noteworthy findings among the interviewees. First, 100% of students surveyed indicated that having AI faculty and staff was important for student retention. Second, 90% of the students indicated institutional commitment with appropriate counseling programs and services for AI students is of high necessity (Falk & Aitken, 1984). Likewise, Adelman et al. (2013) argued that a comprehensive intervention of support and guidance addressing barriers to AI students is necessary throughout preK-16.

Although persistence is desirable for all students attending higher education institutions, some obstacles may be unique to AI students, and to complicate matters further, the differences between reservation and non-reservation AIs must also be explored. It can be presumed that reservation AIs will be more involved in their culture than non-reservation AIs (Huffman, 2003). Therefore, it can be assumed that transition to higher education institutions for reservation AIs will be more difficult.

As in previous literature, Huffman (2003) had the goal of identifying perceived barriers for AI students while attending college. A survey on attitudes, perspectives, and experiences was administered to 101 AI students at a small Midwestern university. The respondents were divided into subsamples of reservation (R) and non-reservation (NR) background for statistical analysis. A Pearson's correlation and t-test were used to determine relationships between variables and comparison between the R and NR

groups on perceptions and experiences (Huffman, 2003). Overall, the barriers identified by AI students were related to academics, finances, and personal/social difficulties. Other findings within this study recognized that R-AIs have more academic difficulty than the NR-AIs, yet financial difficulties, and personal/social difficulties are reported by both subgroups (Huffman, 2003). Financial difficulty aligns with previous research for the general population of college students. Personal and social aspects support the findings by Jackson et al. (2003) where they identified deep themes related to the personal and social aspects. The level of satisfaction with college experiences is the same for both R- and NR-AIs, although the transition is more difficult for R-AI students. Regardless of the easier transition of the NR-AI, the retention rate for this group remains lower than the general population (Carney, 1999).

Success of AI Students. According to Benjamin et al. (1993), focusing on success departs from most studies of retention/persistence of AI students at the higher education level. Thus, focusing on the success of AI populations not only adds to the literature for this particular group, but it may also provide insight for all populations of college students, administrators, and faculty. Furthermore, identifying barriers to postsecondary success for AI students is important to understanding why this group has such low graduation rates.

Jackson et al. (2003) sought to identify barriers for AI students and how they overcome these barriers by interviewing 15 AI college level seniors at 5 four-year higher education institutions in the Southwest. One main criterion for student participant was living and attending school on a reservation for at least two of the last four years prior to attending college. This study had a qualitative method founded on

relational ontology, hermeneutics, and dialectics (Jackson et al., 2003). The results identified surface themes and deep themes, the former was identified and consistent with previous research, but the latter was more personal and complex. Surface themes were related to family and college experiences while the deep themes involved subtle prejudices and racism (Jackson et al., 2003). AI students expressed difficulties within a college environment, yet each theme ultimately involved family support as a coping strategy for overcoming barriers. Ironically, Jackson et al. (2003), also identified student difficulties tied to family, such as the lack of understanding by the family as to why the student must leave home for extended periods of time. In addition, making the commitment to pursue a college degree and thereby leaving the reservation may cause the labeling of the AI student as a "sell out" (Jackson et al., 2003).

In the literature, recommendations for aiding the persistence of AI students typically involve programs to assist in transitions from home to school. Even more, according to Jackson et al. (2003), these programs must also involve tribal leadership. The authors acknowledged that this becomes particularly important for those who lack strong family support. The authors also suggested dialogue between family, high school counselors, tribal leaders, and students starting early in the school years and continuing through college. The subject matter within this dialogue must include coping with loneliness away from home, racism, traditional spiritual resources, bicultural identity, and maintaining cultural identity (Jackson, et al. 2003).

Benjamin et al. (1993) argued that since AI success is such a rarity, scholarly literature has paid little attention to it. Even though higher education institutions are becoming more aware of the cultural background of their AI students, they may still

feel isolated from their instructors. For example, the AI student may lack background familiarity of certain classic literary works (Bergstrom, 2012). Benjamin et al (1993) considered culture in their study to determine skills required for AI college persistence. They used a mixed method of social science and statistical methods using a culturally sensitive approach. Acknowledging Tinto's (1975) model, Benjamin et al. (1993) found that when applying standard statistical procedures for AI persistence it lacked predictive power. Therefore, their focus shifted to a more qualitative method. In their study, they sampled 166 AI college freshmen from various tribes at a Southwestern mid-sized university.

Benjamin et al. (1993) found that while most AI students had marginal academic traits, the individuals who had a stronger educational background also lacked persistence at college. College persistence is often tied to family encouragement (Jackson et al., 2003). Yet, Benjamin et al., (1993) determined the action of "going home" is often disruptive and complicated for AI students, especially since most AI students lack transportation and live far away from home. This phenomenon is often overlooked in the literature. For this reason, Huffman (2003) indicated that reservation AIs have a more difficult time transitioning to college culture than non-reservation AIs.

There are a number of AI students entering college that come from lower quality schools, like those found on reservations, so their struggle is understandable (Carney, 1999). Students of color are often overlooked in major quantitative studies of college engagement at white universities where white students are the sampled majority (Lundberg, 2014). Yet, American universities assume all their students know the college "rules of the game" which is tied to "middle-class cultural capital" (Stephens, et

al., 2012). This becomes significant since AI youth often come from the poorest families and often live in substandard housing (Bowker, 1992). The difficulty of attaining a college degree remains prevalent within the AI community. Bergstrom (2012) contends that AIs have historically been treated differently by the dominant culture; thereby making U.S. public schools an uncomfortable place. Moreover, leaving a community with large family ties for non-Indian colleges can be expensive and traumatic for young AI students (Reyhner & Eder, 2004). Nevertheless, some AIs persevere through a K-16 system and successfully earn a college degree.

Oosahwe (2008) applied a phenomenological study to better understand the successes of AI college students. Although her research questions had a component focused on the "role of tribal identification" in AI college experiences, success factors remained Oosahwe's priority. Oosahwe's (2008) study used purposive sampling to identify both graduate and undergraduate AI students at a large Midwestern university. The participants in this study identified processes and strategies of persisting through their college experience through interviews, shared experiences in focus groups, and written journals to allow further reflection when away from formal settings. The most significant factor identified for success by AI students was motivation. The three areas of motivation were specifically tied to the areas of family, giving back to their community, and cultural identity (Oosahwe, 2008). Making their parents proud was a motivational force, which often included other family members such as aunts, uncles, and cousins (Oosahwe, 2008). Additionally, giving back to AI communities was another driving force for motivation; this was often related to tribal government employment.

According to Guillory (2008), family is often the most important factor for success followed by giving back to the tribal community. Another source of motivation included entering fields that need AI representations such as teachers and cultural identity; this was interpreted as positive representation of their families and community.

According to Oosahwe (2008), strategizing success for the participants is cyclical and not linear. It begins with motivation as the key factor, followed by coping with obstacles through prayer and spirituality, friends, and AI faculty and staff support. Next are strategies through self-efficacy, positive help-seeking attitudes, and mentorships. Once academic success is achieved, the pathway returns to the students' motivational desire of giving back to their community (Oosahwe, 2008). Realizing that motivation is the key factor for success, she acknowledged that further research may expose other factors related to AI higher education experiences, especially since little research is conducted in this particular area (Oosahwe, 2008).

Chapter Summary

It is important to remember the history between AIs and the European Americans and how policy influenced education (Anderson, 2012). From the beginning, the major goal of education was to civilize AIs (Layman, 1942). To civilize through assimilation has been both implicit and explicit. From the beginning of colonization and into the twentieth century, policies would be styled toward the destruction of culture and language to convert AIs into mainstream America (Glenn, 2011). According to Reyhner and Eder (2004), the ambitious policies of the U.S. government supported tribes, and yet, also destroyed them.

In most historical accounts, the atrocities and near genocide that was the result of how AIs were treated has been ignored (Gollnick & Chinn, 2009). Policies that removed AIs from their traditional lands and placed them on reservations did nothing but hinder what the government desired. Furthermore, separation from their extended families by the allotment policy, and early boarding school attendance by coercion further hindered the education process (Juneau, 2001). AI students were stuck between two worlds, their tribal community and mainstream America. As Layman (1942) contended, "Those who had reached their white teachers' standards were, for the most part, a tragic group. They were ethnologically Indian yet by reason of their education, they were neither accepted by their own people nor contented to live among them" (p. 160).

Along the educational journey of the AI, it was only after the 1928 *Merriam Report* to Congress that the theoretical focus of the government began to shift away from the destruction of language and culture. During the era of self-determination (1969-1989) a true shift in methodology occurred where the AI had input into what their children were taught in schools. Teaching AI students non-Indian ways is not undesirable as long as it is not at the expense of AI culture (Reyhner & Eder, 2004). Thus, AI self-determination considerably changed the curriculum from converting AI children at the cost of their own culture.

Self-determination also helped higher education make tremendous progress. Since the founding of the Navajo Community College in 1968, there has been a positive movement towards establishing AI colleges. Presently, there are three federally run higher education institutes currently active, Southwestern Indian Polytechnic Institute in

Albuquerque, NM, the Institute of American Indian Arts in Santa Fe, NM, and Haskell Indian Nations University in Lawrence, KS. In total, there are 32 fully accredited AI higher education colleges and universities operating in the United States (U.S. Department of Education, 2015). Each college has the purpose of maintaining self-determination, tribal identity, and community service while providing numerous academic programs offering certificates and degrees (AIHEC, 2014).

The desire to develop curriculum at the terms of the AI people is a major shift in theory and methodology. However, while the tribal community college movement grows, the instructors are often non-Native (McClellan et al., 2005). In fact, there are very few AI faculty members in higher education institutions across the United States (Guillory & Wolverton, 2008). This is significant since research identifies mentorship as a positive retention factor for AI students (Falk & Aitken, 1994).

There are common themes within the literature associated with student retention such as family support, financial support, and academic preparation; yet, other themes are more detailed, such as on-campus environments, the lack of AI faculty, and cultural boundaries between AI communities and the higher education institutions. And still, other studies are more specific focusing on high school to college transition for reservation and non-reservation AI students. The literature addressed in this chapter involves active students mostly as undergraduates. The answers to questions of how some AIs successfully complete graduate STEM degrees are missing components in the existing literature. Furthermore, the findings and suggestions for increasing the number of AIs graduating from postsecondary institutions have not come to fruition. According

to Adelman et al. (2013), the equity of opportunity along with social justice continues to elude AIs.

The following chapter will provide a methodological plan to contribute to the literature by providing information for anyone working closely with AI students within all levels of the U.S. formal education system, but more specifically in the area of STEM-related education. I hope to expose more information regarding successful completion of a higher education degree regardless of the student's background or concentration of study. However, the stories of successful AI graduate degree holders in STEM-related fields are the focus.

Chapter 3: Methods

In the past, detailed higher education studies involving American Indians (AI) are minimal compared to boarding and mission school themed research (Carney, 1999). Therefore, the importance of identifying how AI students persist in higher education, especially in STEM-related fields, is a productive endeavor. The significance of this type of study is illustrated best by Bruner (1996) who argued, "A system of education must help those growing up in a culture find an identity within that culture" (p.42). This chapter outlines the qualitative methods that will further the knowledge base related to AI higher education persistence.

A qualitative research method following a phenomenological narrative approach was chosen for this study. Oosahwe's (2008) study titled *Strategizing Success: Narratives of Native American Students in Higher Education* utilized this approach to identify success factors of AI college students; however, this study is specifically concerned with AIs who have earned a graduate STEM-related degree. Phenomenological research is interested in first-person recollection of lived past experiences while gaining knowledge and understanding of the meanings and descriptions of those experiences (Moustakas, 1994). The narrative approach allows the researcher access to past-lived experiences that are not available for direct observations, yet it gives the ability to make meaning of individual events to build a meaningful whole (Polkinghorne, 1988). Furthermore, Sandelowski (1991) asserted that a narrative approach allows for the proper context of life experiences as it pertains to time, order, and change.

Interviewing participants will be a significant part of the study. Kvale and Brinkman (2009) suggested that interviewing is an important aspect of qualitative research since it allows the researcher into the subject's view of the world and their lived experiences. The importance of successful AI graduates telling their stories of success through these methods will provide further understanding of AI persistence in STEM-related fields. Additionally, it will also provide information of a time frame when these AI graduates became interested in STEM-related fields.

Researcher's Background

I am a member of the Otoe-Missouria tribe of Oklahoma with affiliation to the Comanche and Kiowa tribes of Oklahoma. I attended K-12 in the U.S. public school system and later earned a graduate degree in a STEM-related field. Curious to discover if other AIs shared similar experiences, I began researching available literature as it relates to AIs and STEM education. I found minimal research in AI higher education and no research in the specific area of graduate degreed AIs in STEM-related fields. With the low numbers of AIs holding graduate level degrees in STEM-related fields, I desired to explore the challenges for AIs pursuing a STEM-related degree. During my own struggles, I was encouraged by my grandmother to remain in school; she earned a Master's degree.

While attending college, it became apparent that AI students were scarce in STEM-related fields. When I became a college instructor of biological sciences, I noticed low numbers of AIs in STEM-related fields. This is especially bothersome since I attended and taught in Oklahoma and New Mexico, two states with high AI

populations. These experiences as a student and educator are the driving force for my research topic.

Setting

This study will be conducted at a large public West South Central research university, which will serve as a central hub for data collection. The participants for this study are located in various locations throughout the United States. The preliminary lists of participants are located in Arizona, Oklahoma, Louisiana, Minnesota, Montana and New Mexico. The states may change before the study begins due to participant agreement. The participants were identified through introductions at various conferences involving minority education and tribal college initiatives, and past AI STEM cohort recruitment at the University of Montana. The majority of the participant's professions in this study are in higher education institutes ranging from a small two-year college serving AI students to a large public university. The minority professions in STEM-related fields will be within the private sector.

Sample/Participants

The participants in this study will be identified as an AI that have attained a graduate level degree in a STEM-related field using the following three criteria: (a) having an earned graduate degree in a STEM-related field from an accredited United States institution; (b) being a member of a federally recognized tribe; and (c) self-identifying her/himself as an AI while attending the degree granting institution. Purposeful sampling will be utilized to insure true representation of the AI population. Furthermore, this type of sampling ensures that the participants have experiences related to the research questions and phenomenon studied (Creswell & Clark, 2011). It is the

intention of the researcher to add as much diversity to the sample by seeking individuals with a variety of STEM-related majors, i.e. chemistry, forestry, health sciences, and mathematics.

Participants will be contacted informally to identify interest in the study, and then a formal invitation (Appendix A) will be issued through e-mail. The researcher has identified at least eight individuals (three females and five males) thus far that fit the criteria for this study. According to Creswell (2014), a phenomenological research method typically has three to ten participants. It is the intention of the researcher to provide equal representation of males and females with a minimum of six participants in this study.

Measurements Instrument

A series of open-ended questions and topics will be developed using previous research as a guide. Prior to administering questions, a field test will be conducted using an AI that meets the STEM-related degree criteria for instrument validity and feasibility. An interview protocol will be followed to ensure consistency between interviews and to minimize bias. Interviews will be conducted through e-mail correspondence and telephone conversations for the convenience of the participants who are located throughout the United States. E-mail correspondence and telephone also provides an avenue for data collection at various times of the day and week (Rea & Parker, 2005). Interviews are expected to occur more than once since follow-up questions will be necessary to provide further detail addressing the research queries.

The questions serving as a guide for the interviews are as follows:

1. What are the factors that influence AIs with a STEM-related degree to become interested in science?

2. What are the factors that allow AIs to complete a graduate degree program in a STEM-related field?

Since no research studies currently exist that ask these particular questions, a series of open-ended questions will be developed to expose the most information possible as they pertain to the research's guiding questions. Careful considerations of the literature and the researcher's past experience have assisted in choosing questions to expose information that will ultimately lead to more specific follow-up questions. The following interview questions were modified from Guillory (2009), Oosahwe (2008), and Bergstrom (2012) and will be asked in either a written and/or interview format.

The modified questions are as follows:

1. When did you become interested in STEM-related education?
2. What event(s) and/or people influenced your interest in STEM fields?
3. Describe any barriers you encountered during your K-12 level STEM coursework/training.
4. Describe any barriers you encountered during your undergraduate level STEM coursework/training.
5. Describe any barriers you encountered during your graduate level STEM coursework/training.
6. Describe factors that aided in the completion of your STEM-related graduate degree.

Follow-up questions will be developed after the initial interviews to increase the understanding and representation of the participant's experiences and will be used to gain more information as it relates to the original research questions.

Data Collection Procedures

Prior to conducting data collection the researcher will obtain approval from the institutional review board (IRB) at the University of Oklahoma. The researcher recently

completed the necessary IRB training conducted by the University of Oklahoma. The researcher intends to send out general demographic questions to the participants through e-mail prior to conducting interviews. According to Creswell and Clark (2011), e-mail has become an efficient tool for qualitative interview data collection. The demographic questions include the age, gender, location, degree type, highest degree attained, and tribal affiliation. These questions will serve three purposes to: (a) provide the researcher with more specific background information of the participants, (b) expose valuable information leading to more specific open-ended questions leading to the collection of information as it pertains to the guided research questions, and (c) increase the validity of the study (Creswell, 2009). Furthermore, the demographic information will allow for a descriptive overview of the participants to serve as a guide for the participant's background environments (Rudestam & Newton, 2007). Post-demographic and prior to interviews, the researcher will seek guidance from an experienced researcher to ensure that the future data collection questions for the participant's are not restricted but remain open-ended.

Phenomenological researchers typically have a structured interview by preparing questions in advance, which bring out the past experiences of the participants (Rudestam & Newton, 2007). The interview protocol will follow the suggested method by Creswell (2009):

1. Date, location, interviewer, and interviewee
2. 4-5 questions of the original broader research question(s)
3. 4-5 follow-up probe questions to explain questions in more detail
4. A thank you statement

The researcher will also ask the interviewee to take notes during the interview for reflection purposes; this will allow participants to email any information of events that are recalled during their reflection (Oosahwe, 2008). The interviews will be audio recorded with abundant amounts of note taking by the interviewer to increase qualitative reliability (Creswell, 2009).

Data Analysis

Analysis of the qualitative data will be a continuous process comprised of a series of steps. Yin (2011) describes data analysis in five phases:

1. *Compiling*-sorting and ordering refined notes and data
2. *Disassembling*-fragmenting compiled data and assigning codes or themes to the fragments
3. *Reassembling*-reorganizing codes or themes coupled with *disassembling* may be repeated many times in alternating fashion
4. *Interpreting*-using the reassembled data to create narratives
5. *Concluding*-considering all phases to form conclusions of the entire study.

These five steps are interactive and will be "recursive and iterative" in their relationship throughout the study (Yin, 2011, p. 179). Creswell (2009) agreed that qualitative data analysis is interrelated and often nonlinear, yet he asserts that data analysis is built upon a foundation following a hierarchical approach.

In a narrative approach, it is important for the researcher to first listen to all the stories of the participants to identify relationships prior to theme development (Rudestam & Newton, 2007). During the disassembling process the researcher will consider previous literature involved within the area of college persistence, especially if similar themes from the literature evolve during and after interviews of STEM-related graduate degreed AIs. Qualitative validity will be ensured by two methods. First,

triangulation will involve multiple sources of data, and second, by member checking where participant inspect the descriptions of the final themes followed by a final interview (Creswell, 2009). Throughout the data collection process external input from a senior researcher experienced in qualitative methods will be sought to ensure reliability of the study. Furthermore, descriptions of data collection methods, data analysis strategies, and literature comparisons will be described in detail to provide a connection with the findings and the reader.

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APPENDIX B: SAMPLE RECRUITMENT LETTER

Dear Prospective Participant,

My name is Harold Kihega and I am currently a doctoral candidate at the University of Oklahoma in Science Education. I am conducting a study concerned with the low numbers of American Indians (AI) completing a STEM-related degree program. More specifically, I am interested in why AIs persist to complete a graduate degree in a STEM-related field, and when they become interested in STEM fields.

You were chosen because you meet the criteria of being AI and possessing an earned graduate degree in a STEM-related field. Your participation will provide useful information on this research topic. Participants will be asked to fill out a demographic survey, and then participate in an interview over the phone. Participants may also answer a series of questions via E-mail during the research project for your convenience. Participants will be asked to keep a journal throughout the study for personal reflection. Participation is strictly voluntary, and your personal information and identity will be kept confidential. Participants may withdraw at any time without penalty or loss. I will make every effort to make your participation as convenient as possible. This study will provide valuable information for future generations of AI scientists. It will also tell a story of your past experiences. I hope you are interested in participating in this study. My contact information is below.

Respectfully,
Harold Kihega
harold.kihega@ou.edu
405-772-0270

APPENDIX C : INSTITUTIONAL REVIEW BOARD

The UNIVERSITY of OKLAHOMA

Institutional Review Board for the Protection of Human Subjects

Approval of Initial Submission – Expedited Review – AP01

Date: April 06, 2015

IRB#: 5366

Principal Investigator: Harold Kihega

Approval Date: 04/05/2015

Expiration Date: 03/31/2016

Study Title: American Indian Persistence in STEM-Related Graduate Degree Programs

Expedited Category: 6 & 7

Collection/Use of PHI: No

On behalf of the Institutional Review Board (IRB), I have reviewed and granted expedited approval of the above-referenced research study. To view the documents approved for this submission, open this study from the *My Studies* option, go to *Submission History*, go to *Completed Submissions* tab and then click the *Details* icon.

As principal investigator of this research study, you are responsible to:

- Conduct the research study in a manner consistent with the requirements of the IRB and federal regulations 45 CFR 46.
- Obtain informed consent and research privacy authorization using the currently approved, stamped forms and retain all original, signed forms, if applicable.
- Request approval from the IRB prior to implementing any/all modifications.
- Promptly report to the IRB any harm experienced by a participant that is both unanticipated and related per IRB policy.
- Maintain accurate and complete study records for evaluation by the HRPP Quality Improvement Program and, if applicable, inspection by regulatory agencies and/or the study sponsor.
- Promptly submit continuing review documents to the IRB upon notification approximately 60 days prior to the expiration date indicated above.
- Submit a final closure report at the completion of the project.

If you have questions about this notification or using iRIS, contact the IRB @ 405-325-8110 or irb@ou.edu.

Cordially,

E. Laurette Taylor, Ph.D.
Chair, Institutional Review Board

University of Oklahoma – Norman Campus
Institutional Review Board
Description of Study Protocol

1. **Provide a description of the purpose of your study and** your research design. (**Examples**: A pre-test – post test 2 x 2 experiment, with a control group and an experimental group that will receive one intervention. A grounded theory exploration of a topic. A pre-test post-test evaluation of a new classroom teaching method. An online cross-sectional survey of students related to curriculum topic. An 8-week walking study with a control and 2 comparison groups receiving either a diet or exercise message intervention). Guidance: This description should be short and written for a lay reader not for someone in your field. Also, your response should be understandable without the reader having to refer to another study document. Do not cut and paste your thesis/dissertation research abstract.

   This research is interested in the factors that allow American Indians (AI) to succeed in STEM-related graduate degree programs. Purposive sampling for approximately 6 AI participants will be utilized to ensure that the participants fall into the studies specific parameter. A qualitative phenomenological narrative approach will be used to gain knowledge about the past experiences of successful AI graduates. The narrative approach allows the participant to identify detailed life experiences in a verbal or written format (Creswell, 2009).

2. If your study will be conducted internationally, involves the military, involves deception, or includes non-OU research personnel, you should address the following areas related to your proposed study:

   a. deception – the debriefing process that will be used
   b. international research – review and approval of the study by a local ethics council, in country research support, verification of the cultural appropriateness of all study intervention and testing procedures and study documents
   c. research involving the military – the unit that will be responsible for providing IRR or research approval and completion of the applicable DoD research approval form(s)
   d. non-OU research collaborators – provide a contact information, institution of employment, and a description of the specific research responsibilities of each collaborator

   N/A

3. **Describe** your participants (examples: 10 day care directors in Tulsa, 50 employees of ABC Company in Norman, 5 people between 18 and 45 who do weight resistance exercise at least two times a week). **Include** information for each type of participant. Guidance: Many studies gather data from different types of participants such as teachers and their students, employees and their supervisors, kids and their parents. Be sure to provide a description of all types of potential participants and the number of each.

   Participants will be identified from past business contacts and cohort members in a previous graduate degree program. The business contacts and myself were involved in a Tribal College and University cohort workshop and the cohort degree program was at the University of Montana at Missoula. There will be approximately 6 male/female American Indian participants between the ages of 30-60 from across the United States. Each will have an earned graduate

degree in a STEM-related field. The potential participant's careers may include college professors and/or STEM-related researchers at private institutions.

4. **Provide** the inclusion and exclusion criteria for selection for each type of participant. **Where** will you obtain the contact information for potential participants? Guidance: If the information is public, describe the source of the contact information. You may not ask an organization or other entity to provide contact information for potential participants without their (potential participants) consent to release this information. You may ask that institution to distribute recruiting material that includes the researcher's contact information so that potential participants can contact the researcher directly if interested in participating. If you involve an institution or other entity in recruitment activities, upload a signed, site- support letter, on the organization's letterhead, that confirms that the signor has reviewed your research design and is willing to assist you in participant recruitment. Please note that access to contact information as a component of your job function DOES NOT automatically mean that you have access to this information for research purposes. This permission must be provided by your employing organization.

   A pre-screen inclusion for the participant involves three criteria: (a) having an earned graduate level STEM-related degree from an accredited United States institution; (b) a member of a federally recognized American Indian tribe, and (c) self-identifying her/himself as an American Indian while attending a degree granting higher education institution within the United States. The participant's business contact information is public on the Internet through their employer/company/higher education institution. Furthermore, the participants are former colleagues and/or former cohort participants in various NSF funded conferences involving STEM higher education. This method was chosen due to the low number of American Indian STEM-related graduate degree holders in the United States.

5. **Recruitment: Who** will approach potential participants? What information are potential participants given about the study? What safeguards are in place to minimize coercion? **If** the researcher(s) is also the participants' supervisor/instructor, how will you assure that the identity of the research participants remains unknown to the researchers until after (1) the data have been gathered and are de-identified or (2) the class grades have been assigned? Guidance: If the participants are under the direct supervision of the researcher(s) (such as employees or students of the researcher(s)), someone other than the researcher must conduct all recruitment and identifiable data collection activities. Upload recruitment materials, such as verbal or written scripts, email messages, postings to websites, flyers, and/or letters. If you recruit participants who are not at OU, include this language: ***"The University of Oklahoma is an Equal Opportunity Institution."*** For OU mass email – you must have the proper permission to use the email list and must include this language in your email message: ***"The OU IRB has approved the content of this advertisement but the investigator is responsible for securing authorization to distribute this message by mass email."***

   The principle investigator will pre-screen potential participants (script attached to IRB application) via telephone conversations prior to sending IRB approved recruitment and consent letters. If the potential participants pass this initial screening, then a recruitment letter explaining the goals of the study will be sent to each potential participant via e-mail (this letter is attached to the IRB application).

6. **What identifying information will you collect? How** long will you retain participant contact/identifying information? **How** will you store this information during the study? **How** will you dispose of contact information when the study is completed or when you no longer need this information? Guidance: If you do not have permission to report the names of your participants, then it is advisable to assign pseudonyms or study numbers to each participant as soon as the data are collected to reduce the risk to participants if research files are accidentally released. Participants can give you permission to release their identities or to store identifiable research records in the Waiver of Elements of Confidentiality section of the informed consent documents.

   The principle investigator may collect the name of each participant as well as their age, sex, workplace/teaching institution, job description (courses taught or research field), phone numbers, addresses, e-mail addresses, tribal affiliation, and public/private/Bureau of Indian Education school history. The information released through the dissertation may be limited to age, sex, education history, and tribal affiliation. Pseudonyms will be developed to limit identifying factors of the participants. This identifying information will be destroyed immediately at the conclusion of the study. Participant's information will be kept in a locked drawer/file cabinet with the key kept in a separate area, if their information is on a computer it will be password protected and locked in a room when not in use. All collected data will be destroyed at the conclusion of the study.

7. **Provide** a step-by-step description of each of the tasks that participants will be asked to perform during the study. Guidance: Tasks include the consent process, completion of data collection instruments and any intervention or de-briefing activities.

   For each study task, list each task sequentially in the order participants will complete it; indicate the approximate time it will take to complete each task and the setting (such as, in a classroom, in the participants' workplace, in a public place, at home). Guidance: If you have multiple kinds of participants (i.e., students and teachers, employees and executives, etc.), include separate entries for each kind of participant and each task.

   For each data collection instrument, indicate the frequency of administration and the method of administration (i.e., face-to-face, telephone, mail, or via a website). Guidance: Upload a copy of each data collection instrument, including surveys, questionnaires, interview protocols, questions for focus groups, observation recording forms, etc.

   For face-to-face interviews and focus groups/group interviews, describe other persons who are not participants who will be present and the activities of each of these persons. **What** steps will you take to ensure that the discussion is held confidential by all the participants after the focus group? Guidance: All non-participant attendees are considered key study personnel since they have access to identifiable data. If someone other than the researcher will transcribe interviews, a confidentiality agreement should be completed and submitted with your application. A copy of the OU-NC approved confidentiality agreement form should be modified for your study and uploaded with other study documents.

Task	Time	Setting	Method of Administration
Consent Process	1 hour	Phone/e-mail	Phone/e-mail communication
Data Collection	1-2 hours	Interviewee's choice	Face-to-Face Interview
Follow-up Data	1 hour	Phone/e-mail	Phone/e-mail communication

After the initial recruitment, participants will be asked to fill out a demographic questionnaire (attached to IRB application) this should last 1 hour. This will be followed by 1 face-to-face interview with the intent to further understand the participants lived experiences (questions attached to IRB application), the face-to-face interview should last 1-2 hours. Follow-up correspondence will continue (questions will be produced after coding of primary interview) via phone, e-mail, and/or video conferencing, this will ensure accurate findings. Each form of follow-up communication should be less than 1 hour.

8. **What** steps will you take to protect the identity of your participants? If interviews or focus groups are audio recorded and will be transcribed, who will transcribe the audio, and how will participants' identities be protected in the transcripts? Guidance: for audio-recorded data, you can mask the identity of the participants by using software programs such as Audacity (a free download). Also, participants should be addressed by a pseudonym or code during interviews to avoid inclusion of names that make interviewees identifiable or a procedure for de-identifying transcripts must be proposed. Photographs of classrooms should not include any identifiable images of the students under 18 who are in the classroom. If you intend to publicly release audio, video or photography, then you will need to have participants sign the OU Talent Release document.

   Pseudonyms will be created for the participants of this study. Only the principle investigator and researcher advisor will have access to the participant's information. The principle investigator will transcribe and code all audio data using pseudonyms for any identifying characters. The participant's age, sex, degree earned, and tribal affiliation are the only data used to identify participants. All identifiable materials will be locked and/or on password protected computer files.

9. **How** will you store, secure, and dispose of each kind of data in your research records, including paper documents, electronic files, audio/video recorded data, photography and/or research records? **How** will you store and dispose of signed consent documents and master lists that link identifying information to ID code numbers? **For** what length of time will you retain your research records? Guidance: To retain research records that contain identifiable information about the participants (or that contain sufficient information for deductive re-identification) after the close of the study, you will need to provide a justification for this request. In addition, you will need to include the Waiver of Elements of Confidentiality section on the consent documents. For de-identified data sets with no potential for deductive re-identification of participants, research records can be kept indefinitely.

Data type	Storage	Security	Disposal Method	Retention Time

All paper documents, electronic files, and audio recordings will be locked in a drawer/file cabinet in a locked room while computer files will be password protected. All identifiable information will be deleted and/or destroyed immediately following the conclusion of the study.

Signed Consent to Participate in Research

Would you like to be involved in research at the University of Oklahoma?

I am Harold Kihega from the Department of Instructional Leadership and Academic Curriculum, and I invite you to participate in my research project entitled "American Indian Persistence In STEM-Related Graduate Degree Programs". This research is being conducted at The University of Oklahoma, Norman, OK. You were selected as a possible participant because you are an American Indian with an earned graduate degree in a STEM-related field.

Please read this document and contact me to ask any questions that you may have BEFORE agreeing to take part in my research.

What is the purpose of this research? The purpose of this research is two-fold. First, it seeks to determine the critical time frame in which successful American Indian graduates become interested in STEM-related fields. Second it seeks to determine factors that allow persistence of American Indian students navigating through the K-20 school system and eventually a program of STEM-related curriculum at accredited higher education institutions within the United States.

How many participants will be in this research? About 6 American Indians with an earned STEM-related graduate degree will take part in this research.

What will I be asked to do? If you agree to be in this research, you may be asked to fill out a demographic survey and participate in one face-to-face interview. Follow-up interviews will occur after the initial interview.. During follow-up interviews, participants may answer a series of questions via E-mail and phone conversations; this will be done at the participant's convenience. Participants may be encouraged to keep a journal throughout the study for personal reflection.

How long will this take? Your participation should take less than 6 hours divided over several weeks. The researcher will meet with you at your convenience one time; this face-to-face interview may last between 1-2 hours. There may be multiple communication interactions after the initial interview each lasting less than 1 hour. These follow-up interviews may be conducted over the telephone or through E-mail conversations each lasting less than 1 hour.

What are the risks and/or benefits if I participate? Every effort will be made to keep your identity confidential, however there is a slight risk that deductive identification may occur due to the low number of American Indians who have an earned graduate degree in a STEM-related field.

Will I be compensated for participating? You will not be reimbursed for your time and participation in this research.

Who will see my information? In research reports, there will be no information that will make it possible to identify you. Research records will be stored securely and only approved researchers and the OU Institution Review Board will have access to the records.

You have the right to access the research data that has been collected about you as a part of this research. However, you may not have access to this information until the entire research has completely finished and you consent to this temporary restriction.

Do I have to participate? No. If you do not participate, you will not be penalized or lose benefits or services unrelated to the research. If you decide to participate, you don't have to answer any question and can stop participating at any time.

Will my identity be anonymous or confidential? Your name will not be retained or linked with your responses unless you specifically agree to be identified. The data you provide will be retained in anonymous form unless you specifically agree for data retention or retention of contact information at

The UNIVERSITY of OKLAHOMA

Institutional Review Board for the Protection of Human Subjects

Approval of Continuing Review – Expedited Review – AP0

Date: February 14, 2016 **IRB#:** 5366

Principal Investigator: Harold Kihega, PHD(c) ILAC/Science Education

Approval Date: 02/14/2016
Expiration Date: 01/31/2017

Expedited Category: 6 & 7

Study Title: American Indian Persistence in STEM-Related Graduate Degree Programs

Based on the information submitted, your study is currently: Active, open to enrollment. On behalf the Institutional Review Board (IRB), I have reviewed and approved your continuing review application. To view the documents approved for this submission, open this study from the *My Studies* option, go to *Submission History*, go to *Completed Submissions* tab and then click the *Details* icon.

As principal investigator of this research study, you are responsible to:

- Conduct the research study in a manner consistent with the requirements of the IRB and federal regulations 45 CFR 46.
- Obtain informed consent and research privacy authorization using the currently approved, stamped forms and retain all original, signed forms, if applicable.
- Request approval from the IRB prior to implementing any/all modifications.
- Promptly report to the IRB any harm experienced by a participant that is both unanticipated and related per IRB policy.
- Maintain accurate and complete study records for evaluation by the HRPP Quality Improvement Program and, if applicable, inspection by regulatory agencies and/or the study sponsor.
- Promptly submit continuing review documents to the IRB upon notification approximately 60 days prior to the expiration date indicated above.
- Submit a final closure report at the completion of the project.

You will receive notification approximately 60 days prior to the expiration date noted above. You are responsible for submitting continuing review documents in a timely fashion in order to maintain continued IRB approval.

If you have questions about this notification or using iRIS, contact the IRB @ 405-325-8110 or irb@ou.edu.

Cordially,

E. Laurette Taylor, Ph.D.
Chair, Institutional Review Board

Journal Reflection Instructions

Study Title: American Indian Persistence in STEM-Related Graduate Degree Programs
Date:
Time:
Place:
Participant:

Please take time to reflect upon your education career focusing on strategies you used to complete a graduate degree program in a STEM-related field. This is an opportunity to make known information that you may not have remembered during our interview. Please feel free to share information that you feel comfortable contributing. I will eliminate any identifiers and all information will be kept in a locked cabinet in a secure area.

The following is a list of questions from our initial interview:

1. When did you become interested in STEM-related education?

2. What event(s) and/or people influenced your interest in STEM fields?

3. Describe any barriers you encountered during your K-12 level STEM coursework/training.

4. Describe any barriers you encountered during your undergraduate level STEM coursework/training.

5. Describe any barriers you encountered during your graduate level STEM coursework/training.

6. Describe any other factors that aided in the completion of your STEM-related graduate degree.

IRB NUMBER: 5366
IRB APPROVAL DATE: 04/05/2015

Interview Questions

Demographics

Gender: M or F

Age: _____

Highest Degree Earned: _____

Tribal Affiliation: _____

Primary Education K-12: (Mark or circle all that apply)
Public School Private School Bureau of Indian Education School Other

Highest Degree Earned By Mother
No HS Diploma HS Diploma Bachelors Masters Doctorate Unknown

Highest Degree Earned By Father
No HS Diploma HS Diploma Bachelors Masters Doctorate Unknown

Highest Degree Earned By Maternal Grandfather
No HS Diploma HS Diploma Bachelors Masters Doctorate Unknown

Highest Degree Earned By Maternal Grandmother
No HS Diploma HS Diploma Bachelors Masters Doctorate Unknown

Highest Degree Earned By Paternal Grandfather
No HS Diploma HS Diploma Bachelors Masters Doctorate Unknown

Highest Degree Earned By Paternal Grandmother
No HS Diploma HS Diploma Bachelors Masters Doctorate Unknown

The questions on the following page are intended to discover lived experiences during your scholastic career. Please feel free to respond to the questions in the context of educational persistence in your specific area of study within science, technology, engineering, and mathematics fields. Please feel free to alter the spacing in this document to accommodate your answers. You are encouraged to share as much information as possible to provide a better understanding regarding the persistence in STEM-related education for American Indians.

Interview Questions - Part 1

1. When did you become interested in STEM-related education?

2. What event(s) and/or people influenced your interest in STEM fields?

3. Describe any barriers you encountered during your K-12 level STEM coursework/training.

4. Describe any barriers you encountered during your undergraduate level STEM coursework/training.

5. Describe any barriers you encountered during your graduate level STEM coursework/training.

6. Describe any other factors that aided in the completion of your STEM-related graduate degree.

Interview Questions - Part 2 (Based upon answers from Part 1)

Follow-up interview questions will be developed (after the analysis of interview questions part one) to further understand the lived experiences of successful STEM-related graduate degreed AIs.

Follow-up Interview

Script:
The following set of themes and questions are derived from our previous interview and follow-up narratives. Interestingly, these themes are common in all participants involved in this study. I would like for you to review these questions for reflection purposes prior to our second and final interview. Please use your notebook (from the first interview) to take notes while reflecting upon these questions. I am interested in specific experiences related to the following themes and questions. As a reminder, my research goal is to identify factors that assisted your persistence in a STEM-related graduate degree program.

Themes 1-4 involve questions related to teachers/professors; Themes 5-9 are related to the social aspect of school within K-20; and Themes 10 and 11 are centered on family and American Indian culture. I believe any necessary clarification will also occur before and during the interview process. However, if you need additional clarification, then please feel free to contact me.

1. **Theme: Grade school teachers as barriers**
   Could you describe how you coped with teachers that impacted your learning negatively?
   a) Did you have help from either the school (K-20) or family to overcome this barrier? Explain.
   b) How did this incident(s) impact your interest in STEM-related subjects?

2. **Theme: Professor influence as mentors (undergraduate and graduate level)**
   Could you describe in detail your first interaction with a college professor/mentor that allowed you to trust and confide in him/her?
   a) Could you describe the steps you took in developing a student/mentor relationship?
   b) Looking back, what did mentoring mean to your persistence in a graduate level STEM program?

3. **Theme: Dropping a course taught by an unsupportive professor**
   Was the professor unsupportive to some/all students or do you feel it was an individualized occurrence related to culture?
   a) Could you reconstruct the events on how you handled the situation of retaking a course from a different teacher/professor?
   b) Could you explain how changing professors impacted your persistence as a graduate student?

4. **Theme: Excelled in the same STEM-related course (that was dropped) when taught by a different professor**
   After changing professors, could you explain the differences in the new course that allowed you to complete/excel in that particular course?

5. **Theme: Extracurricular activities (athletics, art/music)**
   Could you describe your experiences participating in extracurricular activities during K-12 (sports, music, or art)?
   a) Do you feel these experiences played a role in your persistence during your STEM-related graduate career? Explain.

6. **Theme: College campus visits**
   Did your visit to a college campus influence your decision to pursue a STEM-related college degree?
   a) Could you describe how your family felt about your college visit?
   b) What did the college campus visit mean to your persistence in either undergraduate or graduate college?

7. **Theme: Social challenges**
   Could you describe how you overcame the social challenges you encountered at the undergraduate/graduate level?
   a) Were there social challenges in STEM-related classrooms/subjects only or were challenges present in other classrooms/subjects?
   b) Looking back, do you feel your social challenges were different from other students? Explain.

8. **Theme: Peer influence**
   Can you describe any positive or negative incident(s) involving peers that increased your reluctance or desire to completing your STEM-related college degree?
   a) At what level (K-20) of your school career did peers have the most impact on your interest in a STEM-related field? Explain.

9. **Theme: Collaborative learning**
   Could you describe a specific incident(s) that caused/allowed you to accept/seek support from other students during your K-20 career?
   a) Do you feel this was paramount for your success in graduate level STEM-related curricula? Explain.

10. **Theme: Brevity of familial influence in college experiences**
    At which level of school (K-20) did your family show the most support for your interest in STEM-related subjects?
    a) Could you describe an incident where family support was crucial to your persistence in a STEM-related graduate degree?
    b) Do you feel that peers offered the same/less/more support than family during your graduate studies? Explain.

11. **Theme: Brevity of American Indian culture references**
    Recalling American Indian culture, how and when did it become a significant factor to your present life/work situation?